MARCH, 1959

PRICE $1

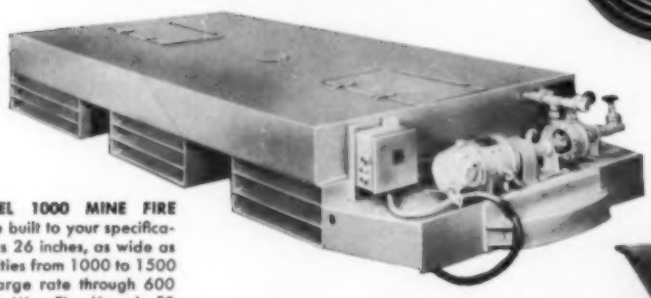
COAL AGE

A McGRAW-HILL PUBLICATION

Coal for Steel... p 66

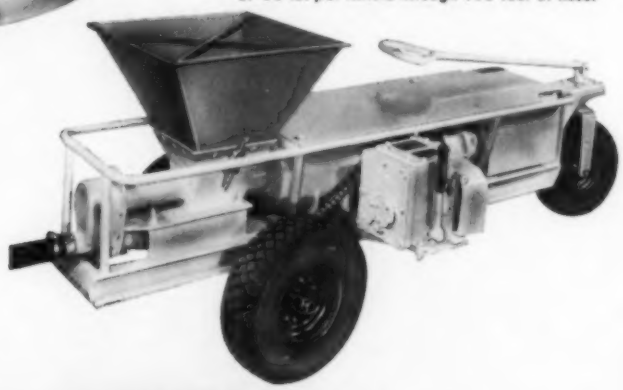
THESE MSA PRODUCTS HELP YOU FIGHT MINE FIRES INSTANTLY

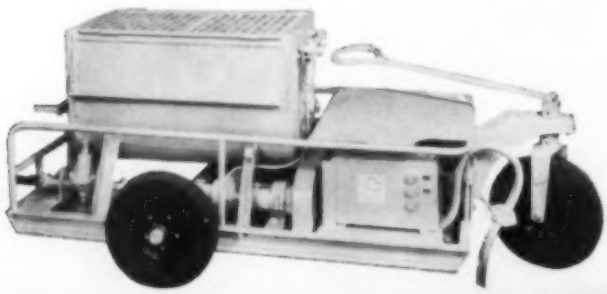
M-S-A MINE FIRE HOSE is especially designed for rugged mine use. It's impervious to rot and vermin. Never needs drying. Lightweight. Easy to handle. Dated and branded for your protection.



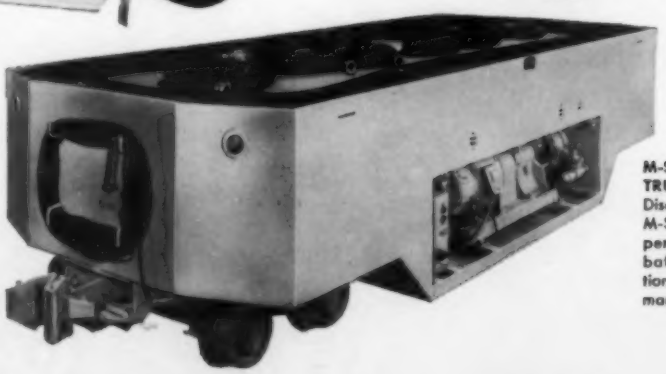
M-S-A BANTAM 400 ROCKDUST DISTRIBUTOR applies rockdust wet or dry. Availability of this machine in the working place, and the men's familiarity with its operation, make it ideal for fighting fires at their inception. Discharges dry dust through as much as 400 feet of hose at an average of 30 lb. per minute. Discharges wet dust at a rate of 50 lb. per minute through 150 feet of hose.

M-S-A MODEL 1000 MINE FIRE TRUCK can be built to your specifications: as low as 26 inches, as wide as 7 feet. Capacities from 1000 to 1500 gallons. Discharge rate through 600 feet of M-S-A Mine Fire Hose is 50 gallons per minute at 50 psi.





M-S-A SLURRY ROCK DUST DISTRIBUTOR can pump a slurry of rockdust and water—the cheapest fire-fighting agents for mine fires—through as much as 1000 feet of hose at the rate of 120 lb. per minute.



M-S-A MODEL 2100 MINE FIRE TRUCK has 2100-gallon capacity. Discharge rate through 600 ft. of M-S-A Mine Fire Hose is 91 gallons per minute at 150 psi. Tank is fully baffled with triple weld construction. Truck is designed for easy maneuverability.

Any delay in fighting a fire may prove disastrous. Often, the sealing of an entire mine or section results. Such an operation is not only hazardous. It's costly.

This threat to human lives and vital mining equipment, however, can be greatly reduced. You can do it with one or more of the indispensable items described above.

A minimum investment in MSA fire-fighting equipment *now*, may save you thousands of dollars later. Write us for helpful literature.

MSA®
SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES COMPANY
201 North Braddock Avenue, Pittsburgh 8, Pennsylvania

MINE SAFETY APPLIANCES CO. OF CANADA, LIMITED
Toronto, Calgary, Edmonton, Montreal, Sydney, Vancouver, Winnipeg

B.F.Goodrich

It's a stomach pump for a coal mine

B. F. Goodrich improvements in rubber brought extra savings

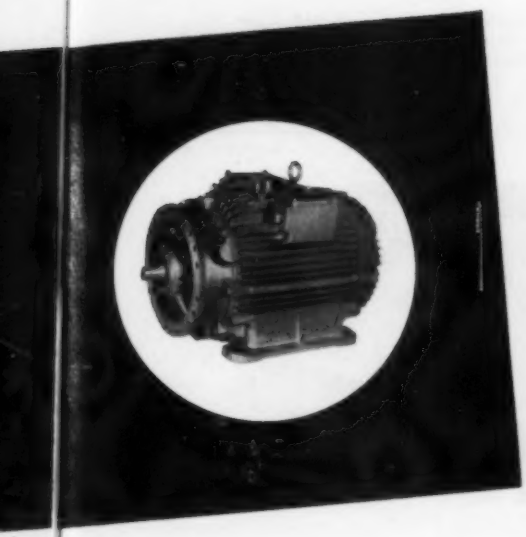
Problem: Getting rid of pools of water that collect in this coal mine is a constant job. Let it accumulate, and in just a few days enough water could pour in to flood the underground pumps, damage machinery, close the mine down. At first, iron pipe was used to drain the pools. But the water contains acid that eats holes in metal. Flexible rubber hose, reinforced with wire, was tried, and worked fine until it was run over several times and crushed flat by heavy mining equipment.

What was done: When a B.F.Goodrich man heard of the trouble, he recommended a B.F.Goodrich hose that springs back to shape when run over. A continuous coil of hemp rope, specially treated and buried in thick rubber, makes this hose strong enough to stand the suction, yet flexible enough to spring back to its round shape after being crushed.

Savings: Since 1953, B.F.Goodrich water hose has worked night and day to keep this mine dry. It has gulped millions of gallons of acid water, been run over countless times by shuttle cars and other equipment. But despite the abuse, it lasts four times longer than the hose used before, saves an estimated 75% in maintenance costs.

Where to buy: Your B.F.Goodrich distributor has exact specifications for the B.F.Goodrich hose described here. And, as a factory-trained specialist in rubber products, he can answer your questions about *all* the rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Company, Dept. M-541, Akron 18, Ohio.*

B.F.Goodrich *industrial rubber products*



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Westinghouse motors are job-proved for all mining applications

Regardless of whether you need a-c or d-c motors . . . regardless of the particular application . . . you'll find there's a Westinghouse motor to do the job . . . a motor which has proved itself time and again for rugged dependability and long operating life.

Combining the most modern materials with proven dependability and durability, Westinghouse motors will help you increase production through more efficient service . . . will help you decrease capital investment by giving you many extra years of reliable performance.

Westinghouse motors . . . either a-c or d-c . . . are available in all ratings, mountings, enclosures . . . standard or special design. Prompt delivery is backed by expert application and service-engineering assistance.

For complete information, contact your nearby Westinghouse representative. Or, write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pennsylvania.

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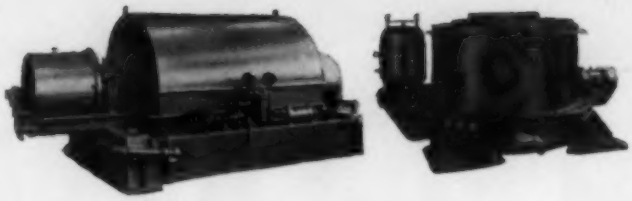
YOU CAN BE SURE...IF IT'S Westinghouse

what you see

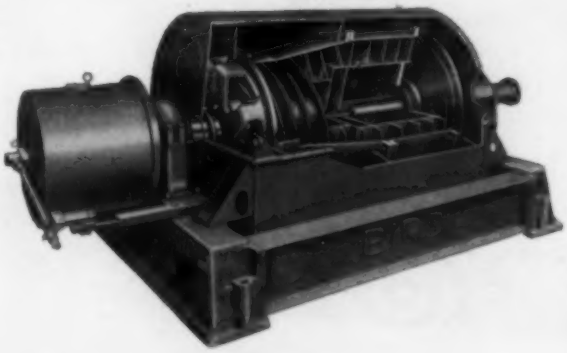


are machines designed and built to dewater fine coal — get it as dry as can be obtained by mechanical means — and do it at lowest cost per ton, write-off, power and maintenance included.

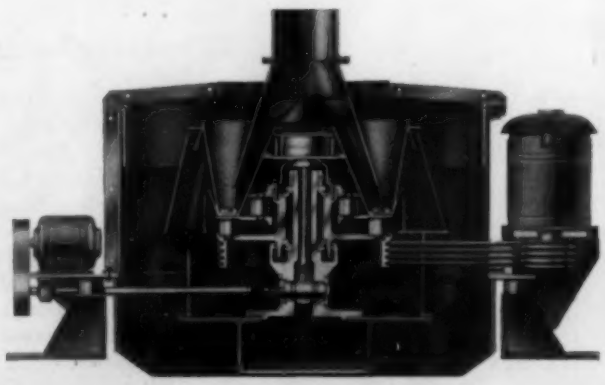
what you don't see

are the hidden values that accompany every Bird or Bird-Humboldt coal dewatering unit

1. expert assistance on layout and installation
2. a careful and competent check on operation and maintenance, not just when the machine is new but throughout the years in order to make sure that it is giving you the highest net return on your investment



Hundreds of Bird Solid Bowl Centrifugal Coal Filters are on the job in preparation plants the country over, handling table feeds just as they come without pretreatment; dewatering minus 28 mesh cyclone or thickener underflows and delivering drier fines at lower cost per ton.



Bird-Humboldt Oscillating Screen Centrifuges are enjoying world-wide popularity as a means of getting ¼" x 28 mesh coal dry and whole with minimum power input (¼ HP per ton of dried coal) and maximum screen life (up to 3000 hours or more).

BIRD
MACHINE COMPANY

SOUTH WALPOLE, MASSACHUSETTS

Regional Offices:
EVANSTON, ILLINOIS WALNUT CREEK, CAL. ATLANTA 9, GEORGIA

This Month in COAL AGE

MARCH 1959

Features This Month:

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► Utilization

Coal for Steel ....

The Future of Direct Reduction ..... *p 66*

W. A. Raleigh Jr., Associate Editor, *Coal Age*

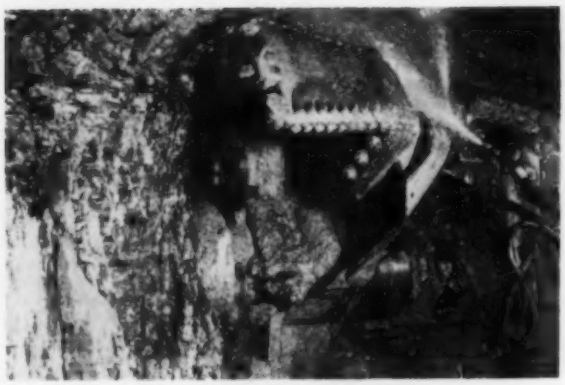
The change-over to direct reduction as the basis for making the Nation's pig iron will come by evolution not by revolution. During the next 10 yr or more, steel will concentrate on reducing costs and increasing capacity through upgrading the efficiency of existing blast-furnace plants. However, as the point of diminishing returns is reached in this effort, few discount the fact that direct reduction has the potentials for upsetting conventional ironmaking practice. What does the change-over mean? Chances are there will be a considerable net gain for coal, providing the industry swings with changing trends in steel technology. The potential plum: A market of 170 to 185 million tons of coal and coal equivalent by 1975.

Along the Way—Panel discussion: "Direct Reduction . . . Progress and Prospects."

► Continuous Mining

Full Pillaring With the Boring-Type Miner . *p 74*

C. M. Hoard, Div. Superintendent, and **C. S. Cressman,** Chief Engineer, Bethlehem Mines Corp.



Over 620 tons per shift in a 6-mo period, compared to an average of 376 tons in the early weeks of operation reflect the success attending application of a boring-type miner to pillaring at Mine No. 41, Bethlehem Mines Corp., Barrackville, W. Va. In the initial 34 mo of operation, also, experience resulted in the adoption of slabbing as the key method of attacking an individual pillar, a change from a 45-deg to a flat pillar line, and the adoption of a rope-frame panel belt to cut delay time to a minimum.

Rounder-Outers—Positive 1,000,000-CM cable for miner, special carriers for cables and hose, keeping the miner headed straight, special supply cars for all materials required, including lubricants; lubricating and maintenance practice.

► Electric Power

Wireless Control of 33,000-V Power . . . . *p 82*

Audio tones from equipment auxiliary to Old Ben Coal Corp.'s two-way radio system are used to monitor and control three circuit breakers at the company's remote main substation. This resort to wireless monitoring eliminates a need for round-the-clock attendants at the substation, and made it unnecessary to move or decentralize the facility. The equipment can be used to switch power to optional lines in the event of out-

(*Continued on p 7*)

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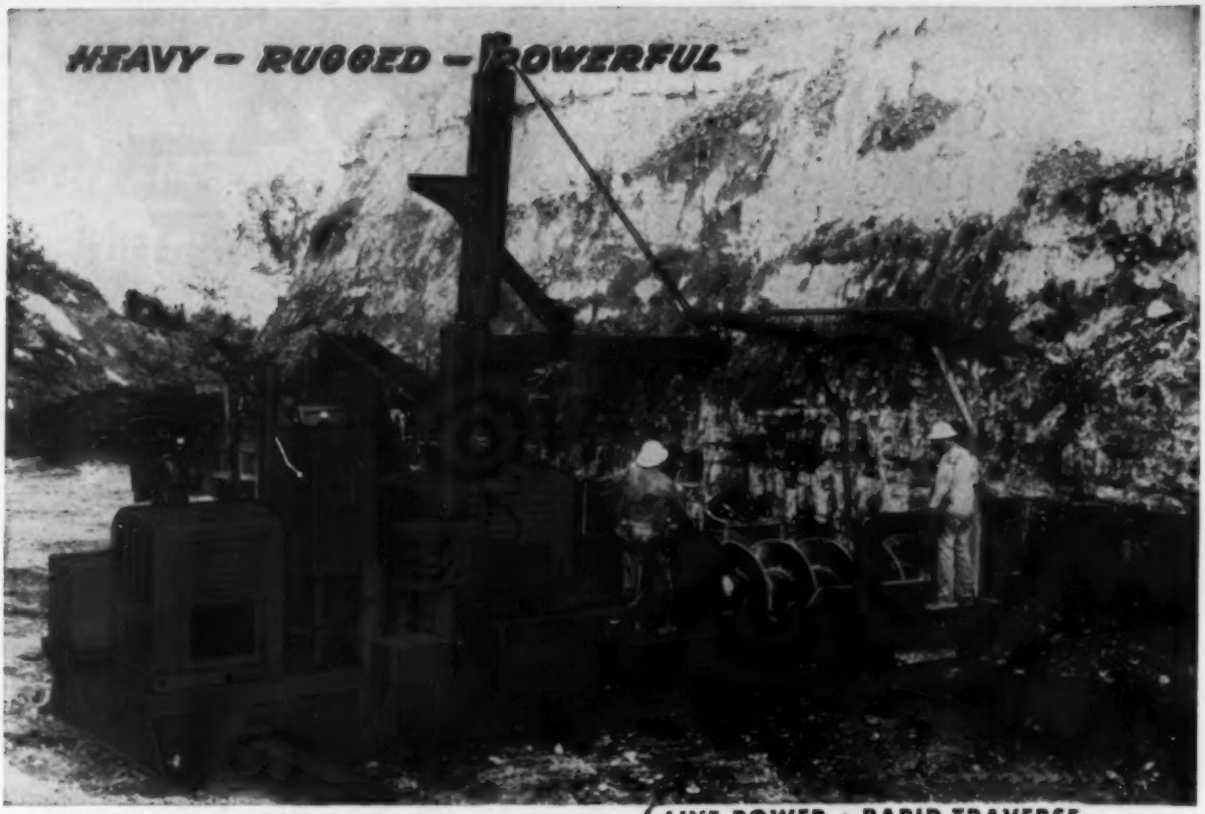


LOWEST COST PER TON WITH McCARTHY AUGER DRILLS

LIVE POWER • RAPID TRAVERSE
SKIDS MOVE SIDEWAYS, FORWARD AND BACK • SAFETY AUGER GUIDE
EASY COUPLING PINS

COAL RECOVERY DRILL

"Walks" from hole to hole to auger high quality coal

An Ohio miner removes 550 tons of coal in each 8-hour working day with this Model 15 36-42x12' McCarthy drill, operated by two men. He drills 42" dia. holes 144' deep. Auxiliary conveyor eliminates spillage at hole. It operates on either side of drill for working blind cut. Twelve different models of McCarthy Coal Recovery Drills mine low-cost "bonus coal."

Manufacturers of Drilling Equipment Since 1901

SALEM

THE SALEM TOOL COMPANY

VERTICAL
MODEL 106-24

World's Fastest Heavy-Duty Vertical Auger Drill

Bores faster, deeper, larger dia. holes than any other auger drill. New gear reduction unit slows auger rotation for operation in hard rock formations. Drills 8" and 9" dia. holes readily in shale and sandstone formations, drills larger dia. holes up to 24" dia. in softer formations.

HORIZONTAL
MODEL 104

Lowest Drilling Costs per Foot, Self-Propelled or Truck-Mounted

Bores up to 12" dia. holes to 150' depth faster, cheaper than any other horizontal drill. Requires less working space, saves many man-hours . . . operates easily in tight, hard-to-reach locations.

FINGER-TIP CONTROL

Gives Desired Rotating Speed of Auger

HYDRAULIC FEED

Provides Any Speed up to 6 Feet per Minute Horizontal Feed of Drill

ages in primary lines. The system covers 36.5 mi of 33,000-V lines.

Top Interest—Explanation of how radio "beeps" control circuit breakers and their reclosing circuits.

► Coal Preparation

Dry Cleaning and Washing Fines At Crichton No. 4 Mine . . . . . *p 88*

Installation of new equipment for dry cleaning and washing fines makes it possible for Johnstown Coal & Coke Co., Johnstown, Pa., to participate in the metallurgical and other quality-consumer markets at home and abroad. The resultant high-grade $\frac{3}{8}$x0 product, features a 3-point reduction in ash percentage. New facilities handle 150 tph, raw feed. Major units include air tables, 2-cell fine-coal washer for cleaning secondary air-cleaner refuse, cyclone thickners and dust collectors.

Highlight—Table shows performance of auxiliary wet washing unit.

► Transportation

Modernized Hauling and Dumping . . . . . *p 94*

A 47% slash in haulage cost and a 51% reduction expense are the results of completely revamping and modernizing hauling and dumping at the No. 25 mine of the Island Creek Coal Co., Ragland, W. Va. The company also notes a great reduction in track and haulage maintenance costs. An added benefit is elimination of delays at the preparation plant resulting from large pieces of rock, which now are broken by a new underground crusher.

Extra—How the new facilities were installed without interfering with normal coal production.

► Strip Mining

Strip-Mine Engineering For Big-Shovel Operation . . . . . *p 98*

W. A. Weimer, Chief Engineer, Peabody Coal Co., St. Louis, Mo.

Stripping with shovels such as Peabody's 70-yd "Big Paul" demands that the pits be carefully designed in advance of the work, otherwise the "calamity" of having a big shovel land-locked might result. Peabody engineers prepare detailed contour maps upon which the planning can be based. Then profiles are prepared from which cuts can be planned to provide maximum spoil room.

Highspots—Graph showing increase in spoil room as radius of outside curvature of highwall is reduced; how the big shovel removes a hill higher than its normal stripping range. (*Continued on p 9*)

This Month in COAL

STILL SLOW FOR BITUMINOUS—The much-advertised end of recession so far has meant little to bituminous coal, which plodded along through January and February at between 8 and 9 million tons a week most of the time, very little different from the pace in the last 4 mo of 1958. Weather interference with operations was responsible to some degree but the big thing was continued shyness on the part of consumers. But business and industry continued to gain, particularly steel, building up pressure on supplies. Consequently, a significant strengthening in the weekly rate is anticipated.

BREAK FOR ANTHRACITE—Weather 20% or more colder than normal brought anthracite a big lift in the closing weeks of 1958 and the openings ones of 1959, though production suffered a setback following flooding of the Susquehanna in January, resulting in the Knox colliery disaster and the closing of a number of neighboring properties for dewatering and recovery work. In addition to lifting the production rate the bulge in demand also was reflected in a heavy drawdown of stocks. These developments, plus rising industrial and commercial interest, give anthracite hope for a continuation of a high level of activity.

OIL RESURGENCE—After a period of relative quiescence, oil refiners and marketers in the North Atlantic area are definitely competing for power-plant business on the basis of both price and long-term commitments. Some success has been achieved, but at the same time there have been some definite failures to knock coal out of the picture. The drive has led to the development of proposals for rate cuts of 50c per ton by the railroads on "incremental tonnage" over that used in a base period, to be accompanied by a 25c cut by coal-company suppliers.

Both refiners and marketers are involved, the refiners in part to move residual they necessarily have to make. Marketers without refinery connections and particularly importers are the biggest problem to coal. And the import tide has been rising. This led the government, and particularly the State Dept., to request a study of imports in January. And this, plus the furor following an announcement that the Commerce Oil Co. planned to import residual from behind the Iron Curtain, led to increased speculation that a showdown on imports is on the way. If so, a question: Will Congress nullify any attempt to impose mandatory controls? The Democratic approach, along with a dedication to higher spending and taxes, greater competition with business, and other "liberal" goals, includes expanding foreign aid and fostering imports, thus making this a real question.

NO CHANGE—Though Mr. Lewis has recovered from his January indisposition, the speculation as to (1) whether he is ready to step down and (2) who might succeed him continues. Prognostication in this field is attended by more than the usual hazards but there is nothing in Mr. Lewis' history or in the present situation to indicate that he is ready to give up the reins. Therefore, this conclusion: As long as he is able to function, Mr. Lewis will continue to be the United Mine Workers of America.

How

RYKON

GREASE

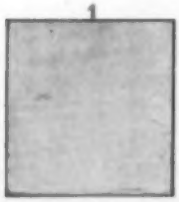
has performed in five tough applications

In just two years since introduction, **RYKON** Grease has stepped in to deliver lubrication in hundreds of applications where other greases have failed

The reason RYKON Grease can perform under conditions that cause other greases to fail is this: RYKON Grease has a unique non-soap, organic thickener. This thickener holds the oil between its fibers better than any other gelling agent. The thickener is able to withstand extremely high as well as low temperatures. It resists chemical action and remains stable under conditions of severe working and water washing. RYKON Grease has exceptional anti-rust properties.

RYKON Grease's unique properties make it truly multi-purpose. This leads to many worthwhile economies. With one grease to do possibly every grease lubrication job in a plant, there's no chance for application mistakes. Inventory and handling of many single-purpose greases is reduced or eliminated. Maintenance training and supervisory follow-up is greatly reduced.

More facts about RYKON Grease are yours for the asking. Call the lubrication specialist in your nearby Standard Oil office in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Illinois.**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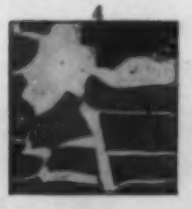
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In the mining industry, where higher speeds, loads, temperatures and pressures are being put on bearings as a means of increasing productivity of equipment, a new type of grease has been needed. RYKON is that grease. Here are just 5 examples of how RYKON Grease has performed in tough spots:

Equipment	Type of Bearings	Conditions	Remarks
Tugger hoists, gears and bearings	anti-friction	high temperature, heavy load	Very good. Holds consistency under high temperature and heavy load.
Conveyors, cars, crushers, hoists	plain and anti-friction	high temperature, heavy load, wet, dirt	Excellent water resistance. Good stability.
Shovels, draglines, etc.	plain and anti-friction	high temperature, heavy load, wet, dirt	Replaced lithium greases.
Drilling rig	plain and anti-friction	high temperature, heavy load, wet, dirt	Replaced lithium greases.
Conveyor outside tipple	anti-friction	— — — — —	Permits cold weather start-up without knocking out breakers.

You expect more from **STANDARD** *and you get it!*

Oven test shows high temperature performance of RYKON Grease. 1. Metal panel coated with RYKON and placed in oven at 350° F. 2. Same panel after five days. RYKON is still soft and ready to lubricate. 3. Another high-melt grease ready for same test. 4. Same panel after oven test. Grease has failed completely.

This Month in Coal Age—Cont'd

► Preparation

Desliming and Heat Drying . . . . . *p 104*

R. M. Grimm, Coal Preparation Engineer, Inland Steel Co., Wheelwright, Ky.

There are numerous ways of desliming, the most common being by classification in water. Advantages of desliming include: (1) Decreased solids in circulating water; (2) reduced load on dust-collecting facilities; (3) possible reduced maintenance on pumps and pipes; (4) decreased ash in clean coal; and (5) decreased moisture in mechanically dried coal. Disadvantages include loss in coal recovery and increase in capital investment. Benefits of heat drying for Inland Steel are: (1) Decreased unloading problem; (2) increased bulk density in coke oven charge; (3) less oil required for bulk density control and (4) lower transportation cost. Inland Steel's Dorr-Oliver fluosolids drier is only the third such unit placed in operation. It is evaporating 18 tph of water while drying 175 tph of ⅝x0 coal.

Extra—How the new drier operates.

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This Month in Mining Practice

MORE NUMEROUS—There still is much to be said for the old 45-deg pillar line, but the total is getting less each day as more and more mines go to low-angle or flat lines, particularly with continuous miners. Flat lines, among other things, simplify layouts, ease the problems of retreating and make it easier to establish dual routes for shuttle cars and thus facilitate haulage without running through curtains or doors, as well as eliminating certain haulage interferences. The immediate jumps in tonnage realized by most who have adopted flat lines is an indication of the likelihood of tons-per-man and per-unit advantages.

BUILT-IN BENEFITS—The numerous developments that have followed the introduction of ammonium nitrate for shooting overburden include the quite-recent one of a factory cartridge with a built-in primer. Ease of handling and greater surety of firing are among the advantages. Those that have started use of the new cartridges report that these and other benefits are being secured.

And for Trucks—One company keeps down cold-weather trouble by electric heaters under the hoods which, when the trucks are parked, are plugged into the shop electric supply.

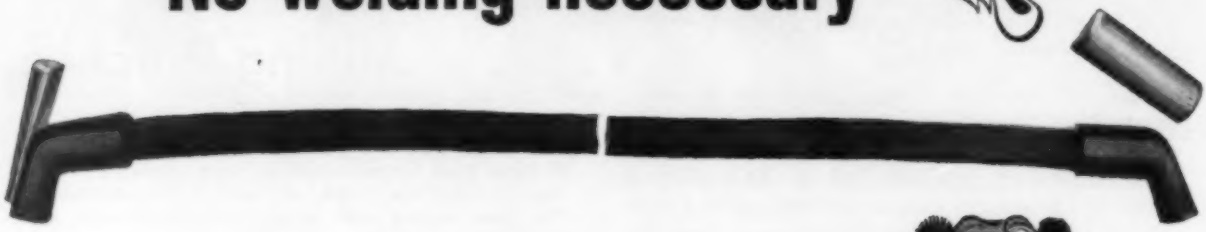
99.6 P.F.—Wherever AC is used—and it is scheduled for major growth in coal mining, not only on the surface, but underground—the question of power factor immediately pops up. Good power factor saves money in a variety of ways, and the techniques and equipment already are available. Good practice? Among other things, a capacitor at each motor, motor horsepowers closely matched to loads, care in the excitation of m-g sets, and so on. Results? At one company, a power factor of 99.6%, plus better operation and lower maintenance.

And Couplers—The higher the voltage, the easier the job of distributing AC. Now, cable couplers rated up to 7,500 V are available, and are showing their merits in their first applications.

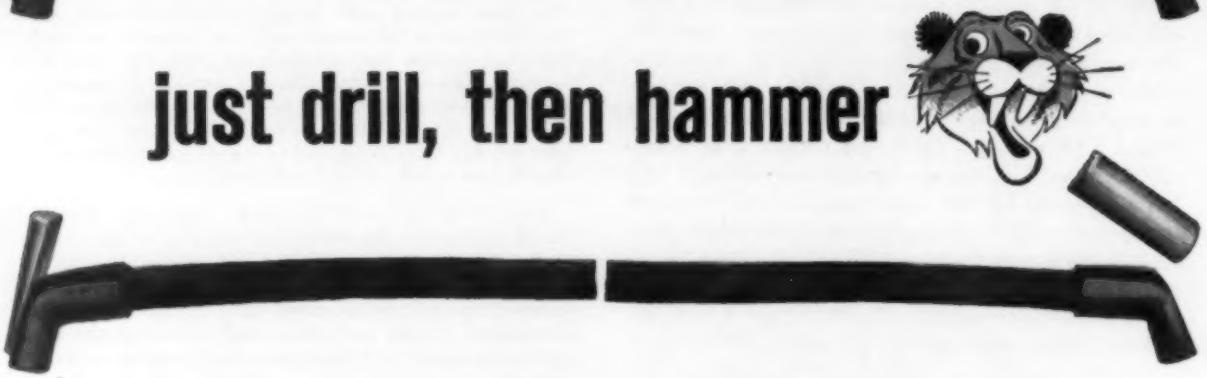
RUBBER FOR SCREENING—The problems of wear, corrosion, efficiency and blinding have plagued users of screens, especially for fine sizes, since the first units went into service. Measures to improve the situation include special wear- and corrosion-resistant metals, heating, adjustment of angle, amplitude and speed, and so on. Now rubber screens of the perforated and thread types are being made available from abroad. The first installations should be yielding data on results in the near future.

BETTER LONGER—The announcement of lubricated-for-life rollers and idlers for crawler-tractor trucks focuses new attention on progress in bearing design, seals and lubricants. The big problem today is to make full use of advances in the art. Since lubrication itself involves a fair sum in cost of materials, in labor and in machine downtime, the need for the best in practice is accentuated. Bearing, seal and lubricant qualities continue to rise, along with their cost, but the benefits in better machine performance more than offset this increase.

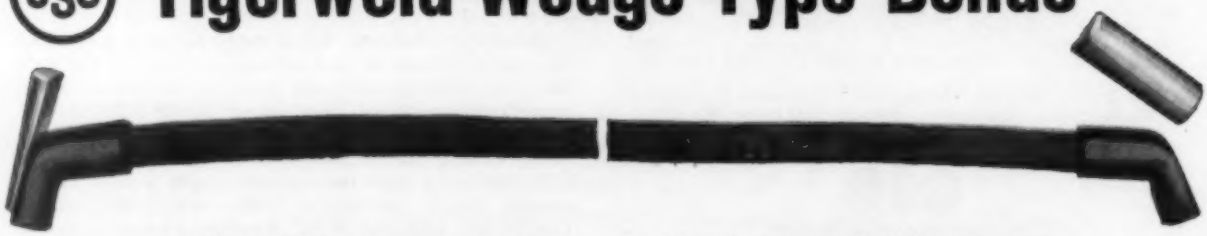
No welding necessary



just drill, then hammer



USS Tigerweld Wedge-Type Bonds



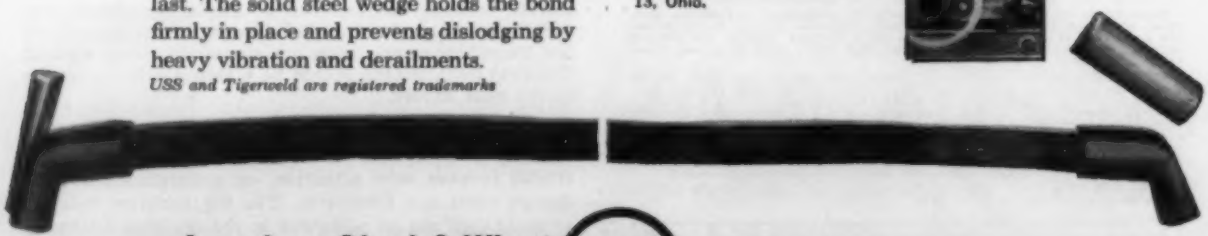
Drill two holes, insert the terminals, hammer in the wedge — your Tigerweld Wedge-Type Bond is installed. There is no precision drilling or welding to do. To remove them, drive out the wedge. They can be reclaimed and used again and again.

Although it takes but a few minutes to install, the Wedge-Type Bond is built to last. The solid steel wedge holds the bond firmly in place and prevents dislodging by heavy vibration and derailments.

USS and Tigerweld are registered trademarks

These bonds are ideal for temporary track because they can be installed easily and used repeatedly. Yet they are so durable that many mines use them on permanent trackage.

NEW CATALOG—Our latest catalog gives full details on all Tigerweld Power Bonds. Write today: American Steel & Wire, Rockefeller Building, Cleveland 13, Ohio.



American Steel & Wire Division of USS United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors • United States Steel Export Company, Distributors Abroad

The Coal Commentator

Opportunities Still

Coal's favorable price and competitive position, as has been said many times, is in large part a result of the billions of dollars that have been spent for machines to do more work more efficiently. Its major hope for a continuation and strengthening of that position is the surety of additional economies through further machine developments and refinements—including automatic miners and transfer stations, and remote-control and communication systems.

Even a quick look shows that the contributions of the manufacturers is a major one. They have taken many forms. The latest, as an example, is a booklet entitled "How to Build Your Own Automatic Car-Loading Units," recently issued by The Nolan Co. In the field of new techniques, incidentally, the booklet discusses a closed-circuit TV setup for checking on station operation.

The opportunities for lower cost and higher quality still are many and worthwhile. Constant checking makes sure that none are missed.

Up for Stripping

Perhaps because it is less susceptible to the effects of recessions, the bituminous stripping percentage, on the basis of preliminary estimates, registered a significant jump in 1958 to 27.4%. In 1957, the proportion was 25.2%; in 1956, 25.4%. At the same time, its associated system—auger mining—rose from 1.6% of the total in 1956 and 1957 to 1.8% in 1958. Thus, the two systems together accounted for nearly one-third of the bituminous output.

The big reason why stripping continues to maintain a firm grip on over one-quarter of the tonnage in both bituminous and anthracite is the increase in range and capacity of stripping and associated units, including drills and trucks. **Thus, even though there have been marked advances in underground method and equipment, stripping has held its own—and probably will continue to do so for some time to come.**

Plus for Coal—The competition in higher-capacity more-efficient equipment means a bigger advantage in the competition with other fuels.

Belt With a Lid

Tricks with conveyors are a specialty of mining men and manufacturers in other countries, with an incidental result the coining of exotic names—"Python," for example. Some developments have possible application in the U.S.; others not. The "belt with a lid" is one of the first group.

The lid in this instance is a cover belt which lies on top of the material on the main belt. As a result, the belt may be operated at a much steeper angle—up to 45 deg or better, compared to the usual 15 to 18 deg—without the material rolling back. **It is already widely used for shorter lifts abroad, and possibly could be adapted to the longer lifts involved in hoisting from underground to the surface.**

There would be a saving in slope and belt length, in part offset by the extra cost of the cover belt and its mechanism. In the light of experience abroad, a considerable saving is a good possibility.

Direct Conversion

Charged with a carbon or hydrocarbon—coal for example—the fuel cell is being studied as a possible future power source. The day when a cell might become practical for power in quantities is a long way off, since, for example, it is not yet known exactly how the cell functions. But if it could be perfected it could provide an efficiency of up to 80% in conversion of fuel to electricity, compared to 42% for a modern boiler plant.

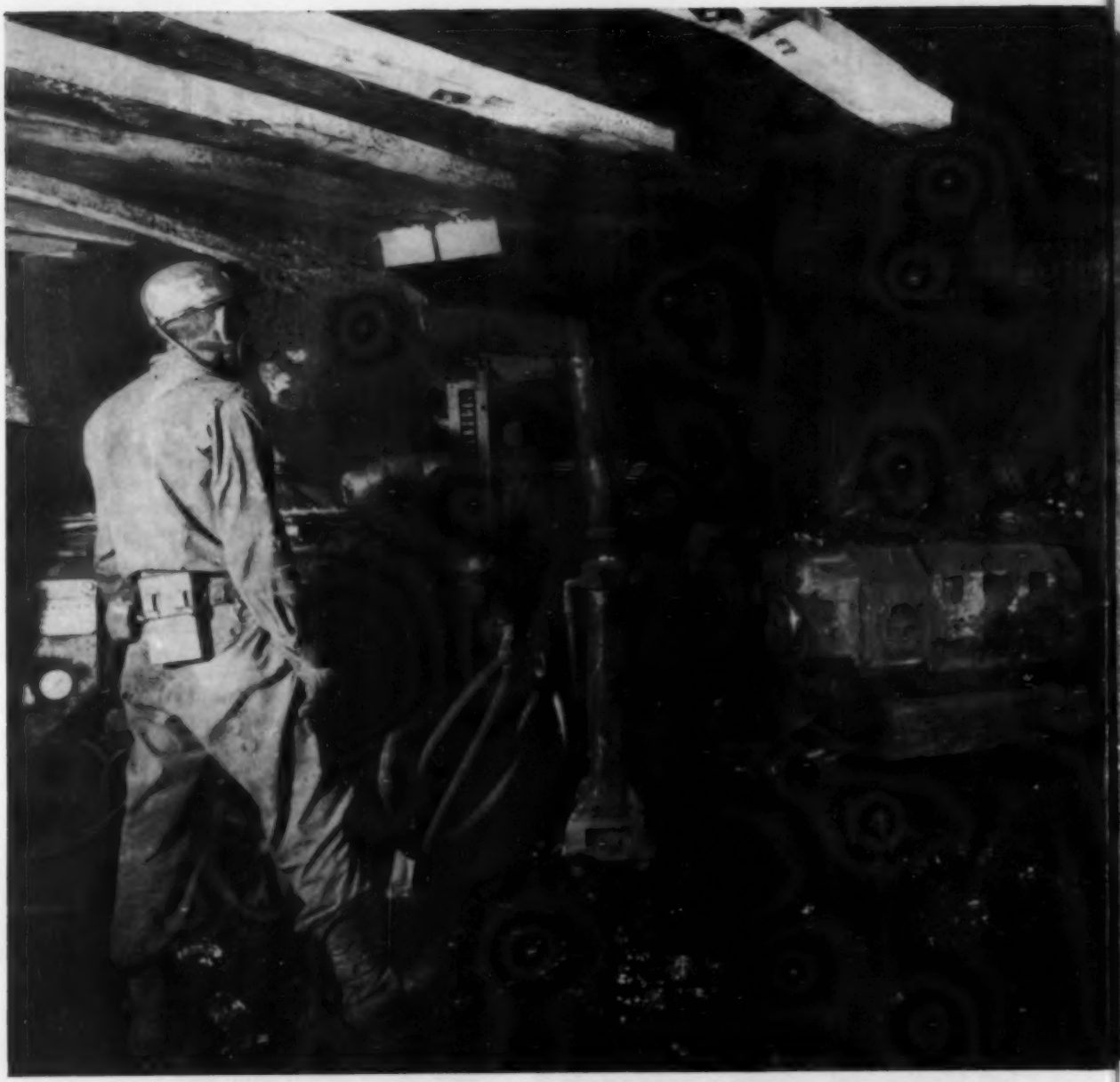
Another possibility being studied is transforming heat directly into electricity—already, like the fuel cell, possible in the laboratory and for certain special applications where cost is a minor consideration and current demands are low.

By and by both these may be serving people's needs for electricity. But like nuclear power, the economics are against much use on a major scale for many years.

Real Progress

Many coal men can easily remember when the industry enjoyed far less public, financial and government regard than it does today. Even 10 yr ago a feature such as that which led off the *Saturday Evening Post* of Jan. 17 almost certainly would never have seen the light of day. And as another example of the improved coal position the Sunday *New York Times* of June 7 will carry a special rate advertising section, which NCA is sponsoring and which will carry the bituminous story to "1,300,000 homes, offices, schools and colleges."

These and other examples of the better favor coal now enjoys are evidence of real progress in service, safety and human relations.



Gulf makes things run better with new lubricant for modern

NEW GULF MINING

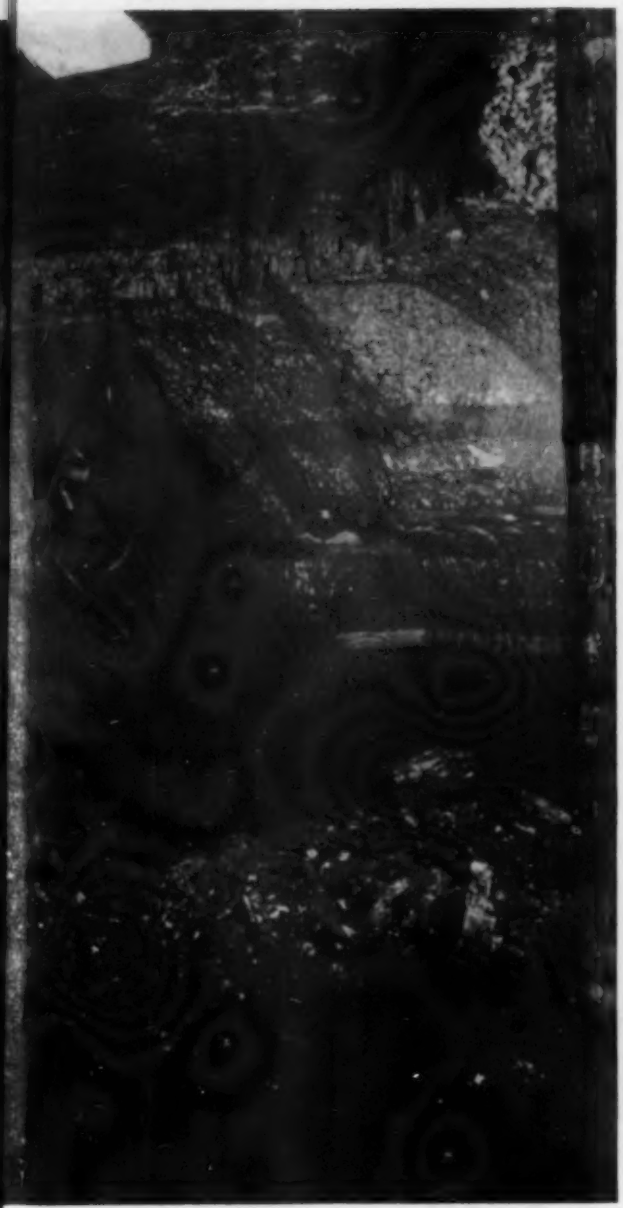
Now you can get more tonnage between overhauls from your continuous miners and other key equipment, with a new heavy duty lubricant—Gulf Mining Lubricant H.D.

This versatile lubricant is a semi-fluid, multipurpose grease that meets every lubrication need at the face, and therefore simplifies application, storage and handling. You can apply it by pouring or with a grease gun.

New Gulf Mining Lubricant H.D. is fluid enough not to channel in a gear case. Yet it has body enough to prevent excessive leakage from drive assemblies operating at high temperatures. In fact, it has "controlled leakage"—bleeds just enough to keep coal dust and other foreign matter from entering gear cases and bearings.

Gulf Mining Lubricant H.D. has high resistance to water, heat and extreme pressures. It inhibits rust and corrosion.

Proved effective in service. New Gulf Mining Lubricant H.D. has been tested for over a



Every requirement for grease at the face can be handled quickly and effectively with new Gulf Mining Lubricant H.D. Use it to lubricate your continuous miners, automatic loaders, cutting machines—all your heavy duty equipment.

mining equipment . . .

LUBRICANT H.D.

year at coal mines in Pennsylvania and West Virginia. It lubricates effectively under the pressures, shocks and high temperatures of modern mechanized mining.

Available now in convenient 35-lb. pails and 120-lb. drums.

Your mine can save time and reduce maintenance costs with new Gulf Mining Lubricant H.D. Try it. You'll see more proof that Gulf makes things run better! Call your nearest Gulf office, or mail coupon for booklet.

GULF

GULF OIL CORPORATION
Dept. DM, Gulf Bldg., Pittsburgh 30, Pa.

Send booklet on new Gulf Mining Lubricant H.D.

Name_____

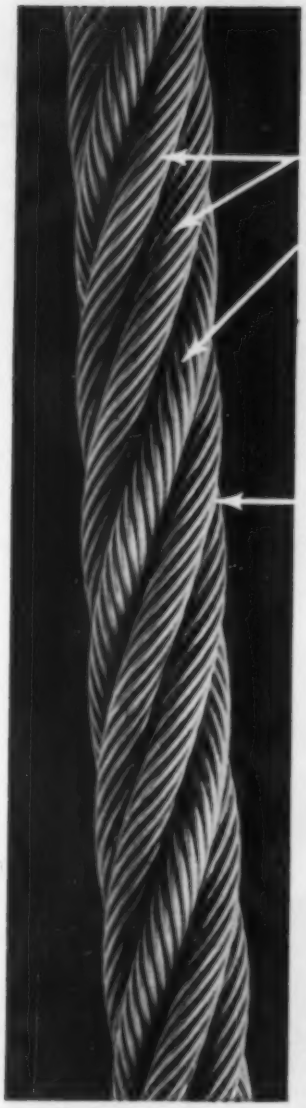
Title_____

Company_____

Address_____

City_____ Zone_____ State_____

CA-5265



Herringbone's two pairs of Lang lay strands and one pair of regular lay strands provide the ideal combination of maximum flexibility with good stability.

Finer wires inside contribute to Herringbone's excellent drum-winding characteristic.

Heavier outside wires in each strand have greater resistance to abrasion.

"...we would never hesitate to recommend it"

GRAY & FEAR, CONTRACTORS

This company continues: "We have been using your Roebling Herringbone* for about one year. We find it is one of the best ropes we have ever used, outlasting previous ropes three to one. It is good that such a reliable rope is available."

This is a direct field quote on the most remarkable development in wire rope in years . . . a new concept in wire rope design. Roebling Herringbone is the regular lay and Lang lay wire rope —two-ropes-in-one rope—combining the best features of both.

Herringbone delivers extra flexibility, extra abrasion resistance, unusual structural stability, extra resistance to shock, easy operation over sheaves and drums and smooth spooling properties.

We recommend Herringbone without reservation for general hoisting and the entire range of heavy-duty equipment. Your Roebling Distributor or Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey, will give the full and fabulous details. *Reg. App. For

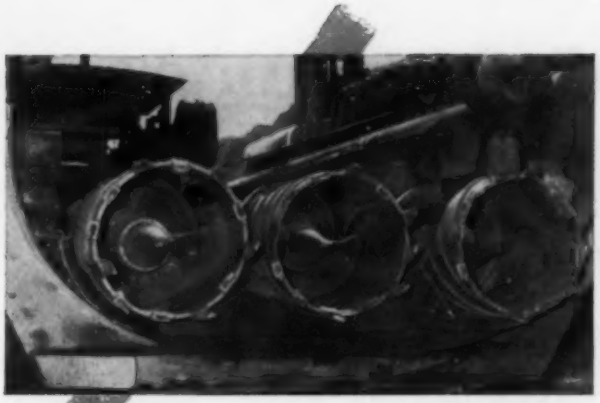
ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

COMPTON

"Triple Head"

COAL AUGER



SMASHES THE THIN SEAM BARRIER!

RECOVERS LOST TONNAGE!

AS THIN AS 24 INCHES

AS DEEP AS 200 FEET

They said it couldn't be done—all-out coal recovery from the thin seam—economically and profitably!

Then the Compton "Triple Head" Coal Auger smashed the barrier by supplying the stopper to the profits that got away—those tons and tons of coal in the thin seam, way back under.

The Compton "Triple Head" Coal Auger moves along the working face of the highwall! Its three cutting heads operate in unison, boring as deep as 200 feet, augering up to 58 tons of clean, saleable coal from a 24" seam in an hour! And the Compton "Triple Head" Coal Auger assures maximum recovery too, drilling within 4¾" of the bottom of the cutting heads, regardless of size!

Seam thickness makes no difference to the Compton "Triple Head" Coal Auger! It drills a double row of over-lapping holes as easily as a single row.

Why not phone for a Compton auger mining specialist today? He will analyze your property and determine if it calls for a "Triple," "Double" or "Single" Head Coal Auger!

Compton, Inc.

CLARKSBURG, WEST VIRGINIA

WHEN LOOKING FOR AUGERS — LOOK TO COMPTON

More tonnage . . . more profits

50% Higher Tonnage with the *new* CM37

For medium and high seams

Backed by the tried and proven cutting principle of the original Lee-Norse Miners, the CM37 brings a new high in operational efficiency to continuous mining. This rugged machine has more power, more capacity and higher tramming speed that results in increased tonnage per man shift.

Check these NEW FEATURES!

- Total weight 25 tons—a 25% increase! Extra weight mostly in improved cutter head where it does the most good!
- More power—fewer motors! Only 3 identical electric motors used . . . conservative continuous ratings . . . no water cooling.
- Heavy duty electric control.
- 14" wide crawler treads with improved hydraulic motor and gearing.
- 24" wide conveyor driven by hydraulic gear motors applied directly to gathering head. Hydraulic start and stop . . . no clutch required.
- Multiple tramming speeds—variable speeds to 50 feet per minute . . . fast tramming at 90-100 feet per minute.
- Increased capacity...4 to 5 TONS PER MINUTE.

Coal high or low? . . .

. . . with Lee-Norse MINERS

For Low Coal . . .

LCM28

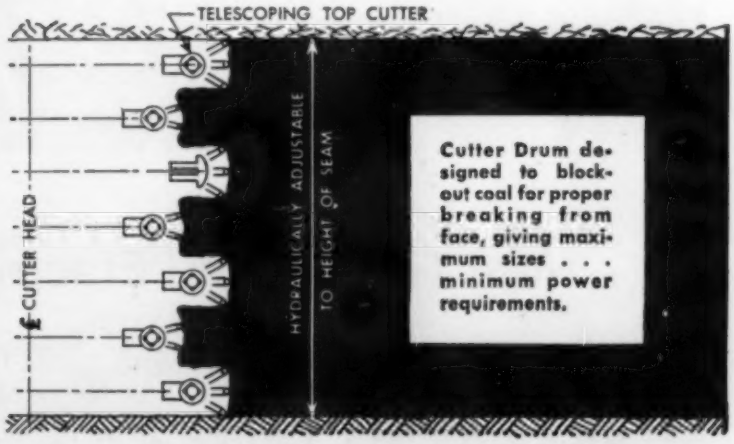
ready for production!

For seams 30" to 48"

Here's how LCM28 *produces profitable tonnage!*

1. Weight 16 tons — rugged and heavy enough to cope with tough cutting conditions.
2. Capacity—2 to 3 tons per minute.
3. Hydraulically driven 24" flexible Conveyor.
4. Two Cutter Heads cut a wide face 16 feet or less.
5. Dual gathering arms have maximum reach of 11 feet . . . will gather ALL the coal regardless of position.
6. Controlled Tramming Speed gives proper sumping action and Dual Pump combination gives high tramming speed.
7. Especially good in cross-cut development!

The LCM28 "Low Coal" Miner employs a new combination of cutting and gathering coal. The vertical mounted extendable cutter drums arc together like a "clam shell."


TELESCOPING TOP CUTTER
CUTTER HEAD
HYDRAULICALLY ADJUSTABLE TO HEIGHT OF SEAM
Cutter Drum designed to block-out coal for proper breaking from face, giving maximum sizes . . . minimum power requirements.

All Lee-Norse Miners are available in AC or DC power.

Lee-Norse Company
CHARLEROI, PENNA.
Specialists in Coal Mining Equipment

Lee-Norse MINERS keep production on the go!

USS Tiger Brand Electrical Wire & Cable

A standard cable for every special job

- Asbestos Wire and Cable
- Mold Cured Portable Cor
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

Even under the toughest working conditions—

Amerclad

puts power where you want it!

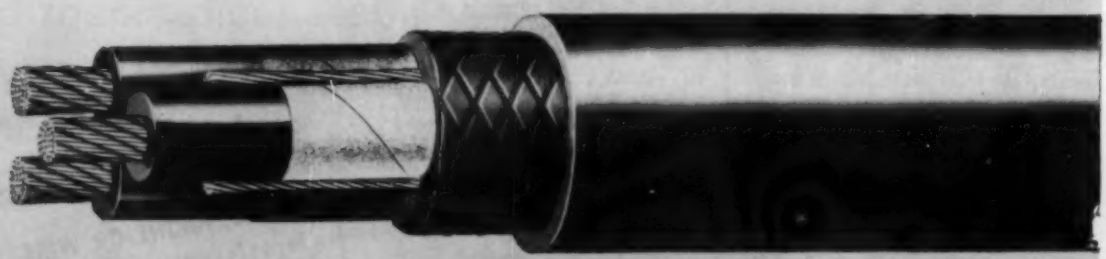
Of all the machines and equipment on your job, none is subjected to more gruelling treatment than portable power cable. And none demands less attention. You reel it out, connect it up . . . and forget it. *That is, if what you are using is Tiger Brand Amerclad.*

For Tiger Brand Amerclad Portable Power Cord and Cable is made *extra* strong and *extra* tough to withstand the worst that man and the elements can dish out. Constant exposure to sun, rain and snow have little or no effect on it; you can drag it over and around sharp rocks, through mud and wet concrete; even run over it with heavy trucks—all without damaging its tough hide.

Tiger Brand Amerclad Cord and Cable consists of flexible, rubber-insulated conductors encased in a tough, resilient protective jacket of Amerprene, an oil-resistant compound of extreme density and toughness that is both moisture-proof and fire-resistant.

For more information, get in touch with your American Steel and Wire salesman. Or write direct to American Steel & Wire, 614 Superior Ave., N. W., Cleveland 13, Ohio.

USS, Tiger Brand, Amerclad and Amerprene are registered trademarks



American Steel & Wire Division of USS United States Steel

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United States Steel Export Company, Distributors Abroad

ANNOUNCING

the New Heavy Medium Cyclone Washer for fine coal, 3/4 inch to 48 mesh

Now available to coal producers in the United States

ROBERTS & SCHAEFER is proud to announce its appointment as exclusive representative in the United States for the famous Dutch States Mines Heavy Medium Cyclone Washer for fine coal, ¾ inch to 48 mesh.

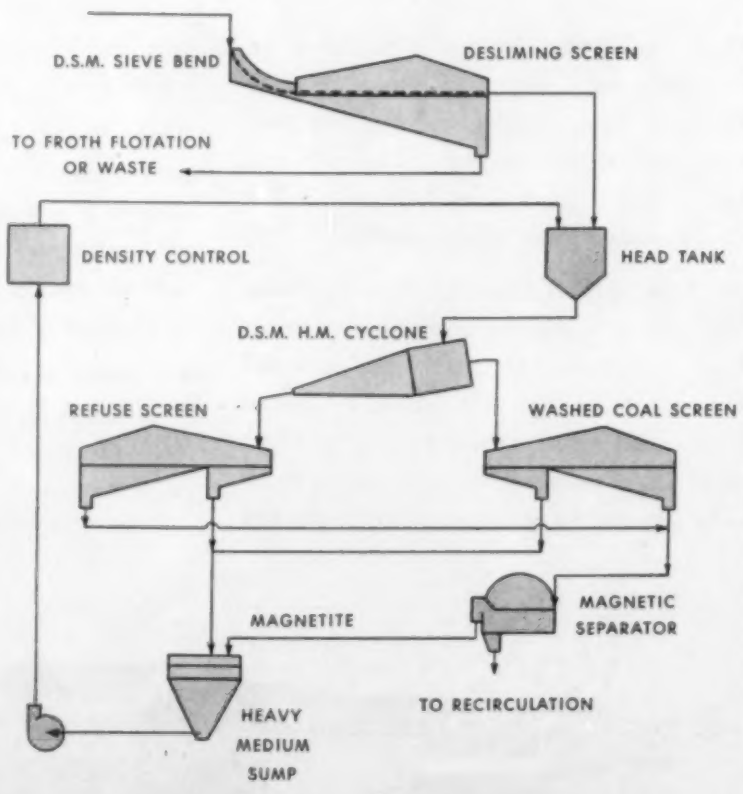
The completely new, heavy medium cyclone washing system will offer many coal producers unique opportunities to improve operations, increase yields of fine coal, reduce costs and deliver a better quality coal to their customers.

Another Exclusive for

ROBERTS & SCHAEFER

During the past 50 years, Roberts & Schaefer has pioneered many innovations in coal processing and cleaning methods and facilities. The new Dutch States Mines Heavy Medium Cyclone Washing System is another exclusive feature of the flexible and comprehensive service provided to the nation's coal mining industry by Roberts & Schaefer.

FLOW DIAGRAM OF DUTCH STATES MINES
HEAVY MEDIUM CYCLONE WASHING SYSTEM



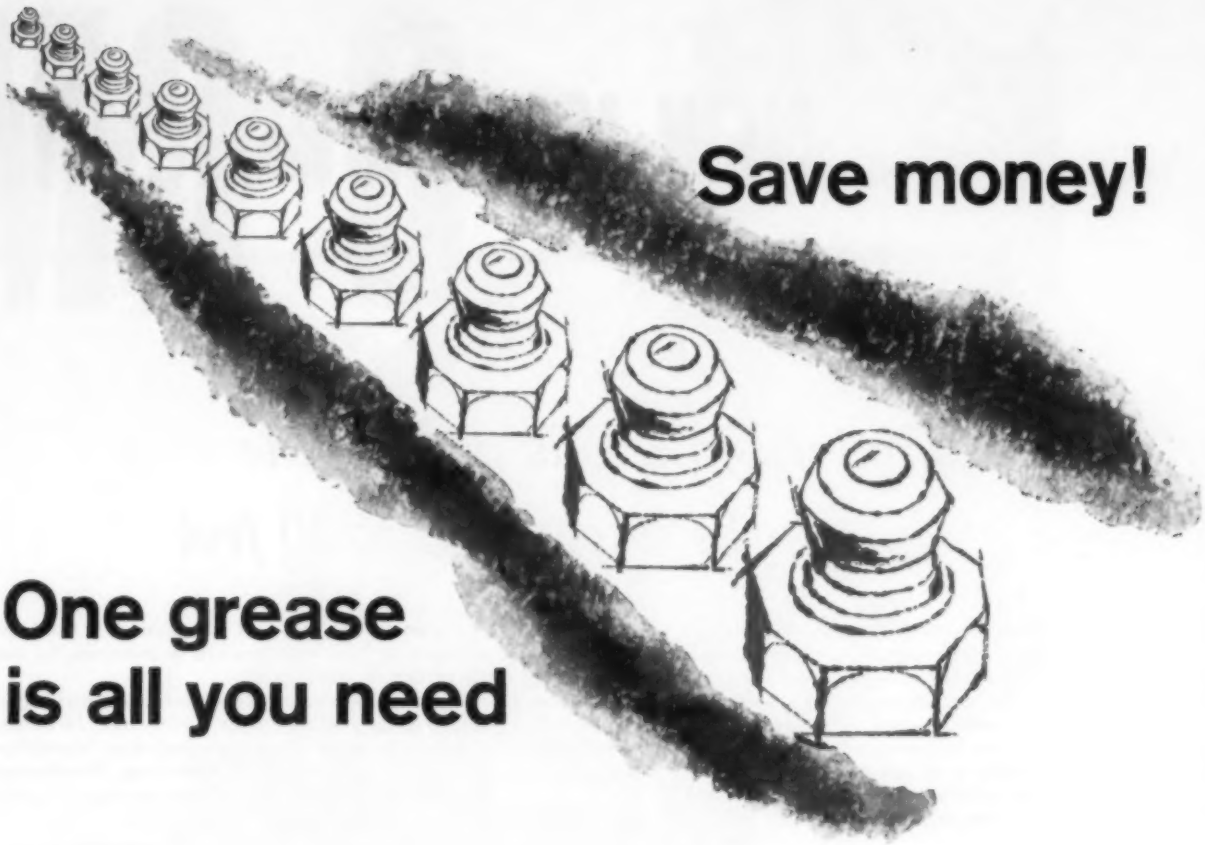
WRITE, PHONE OR WIRE for information about the new Heavy Medium Cyclone Washer. Our engineers will be glad to discuss the application of this system to your present operations.

ENGINEERS & CONTRACTORS

ROBERTS & SCHAEFER Company

120 NORTH WELLS STREET, CHICAGO 6, ILLINOIS

NEW YORK 19, N.Y. • PITTSBURGH 22, PA. • HUNTINGTON 10, W. VA. • ST. PAUL 1, MINN.

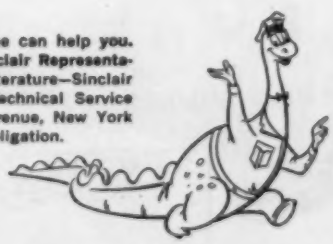


Save money!

One grease is all you need

If you use several greases to lubricate your plant equipment—stop! You'll save money with Sinclair Litholine® Industrial Grease because this one grease simplifies inventory, saves time. Recommended for all types of bearings. It has also earned an enviable reputation for high temperature bearing performance and mechanical stability. When management asks how you've cut costs, tell them you've switched to Sinclair Litholine and show them the results.

Find out how Litholine can help you. Call your nearest Sinclair Representative, or write for free literature—Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. There's no obligation.



SINCLAIR

Litholine® Industrial Grease

NEW JOY 6-CM

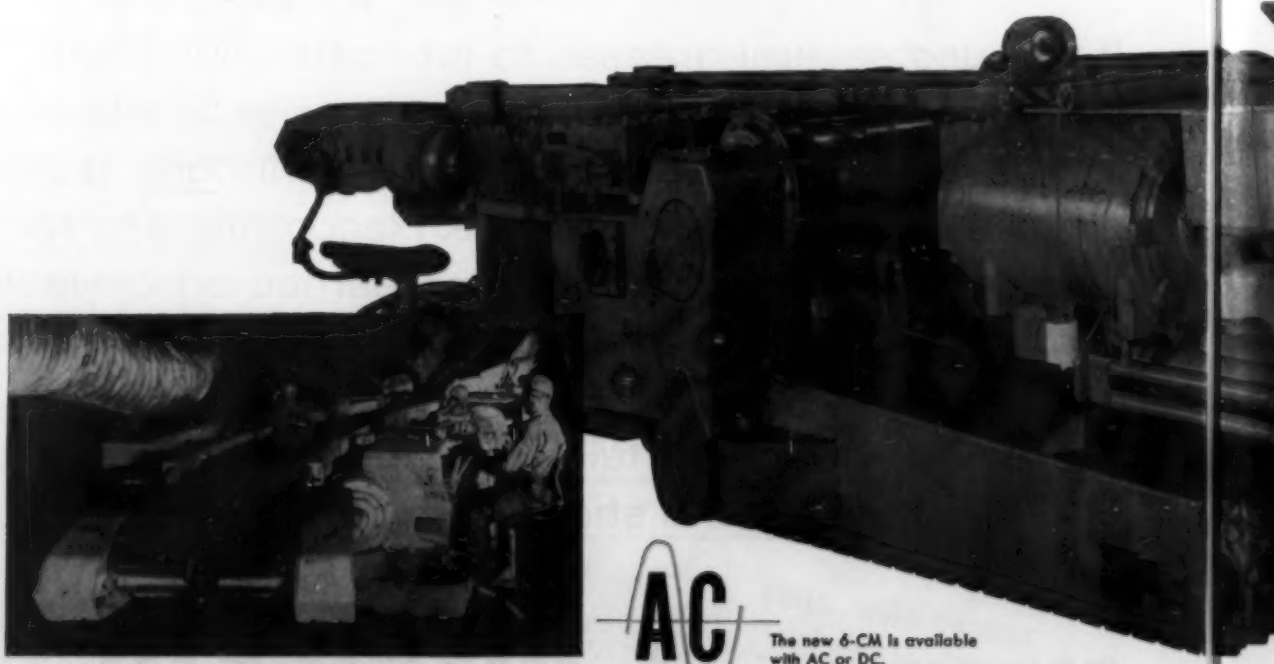
produces 5½ tons per minute
works in coal 5½ to 10 feet

The new Joy 6-CM is an entirely new machine, 48" high, with every feature engineered into it to accomplish higher tonnage and lower maintenance cost.

The gathering arm clean-up, and the conveyor are each powered independently of the ripper head . . . the Miner can do auxiliary clean-up while the shuttle cars are changing. The coal is stored on the conveyor for immediate unloading.

Extra-wide crawler treads and extra-high ground clearance make the 6-CM sure-footed on the poorest bottom. The crawlers are gear-driven for fast tramming . . . 85 fpm.

If you are operating a coal seam 65" and higher talk to a Joy engineer about the 6-CM, the newest continuous miner on the market. **Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*



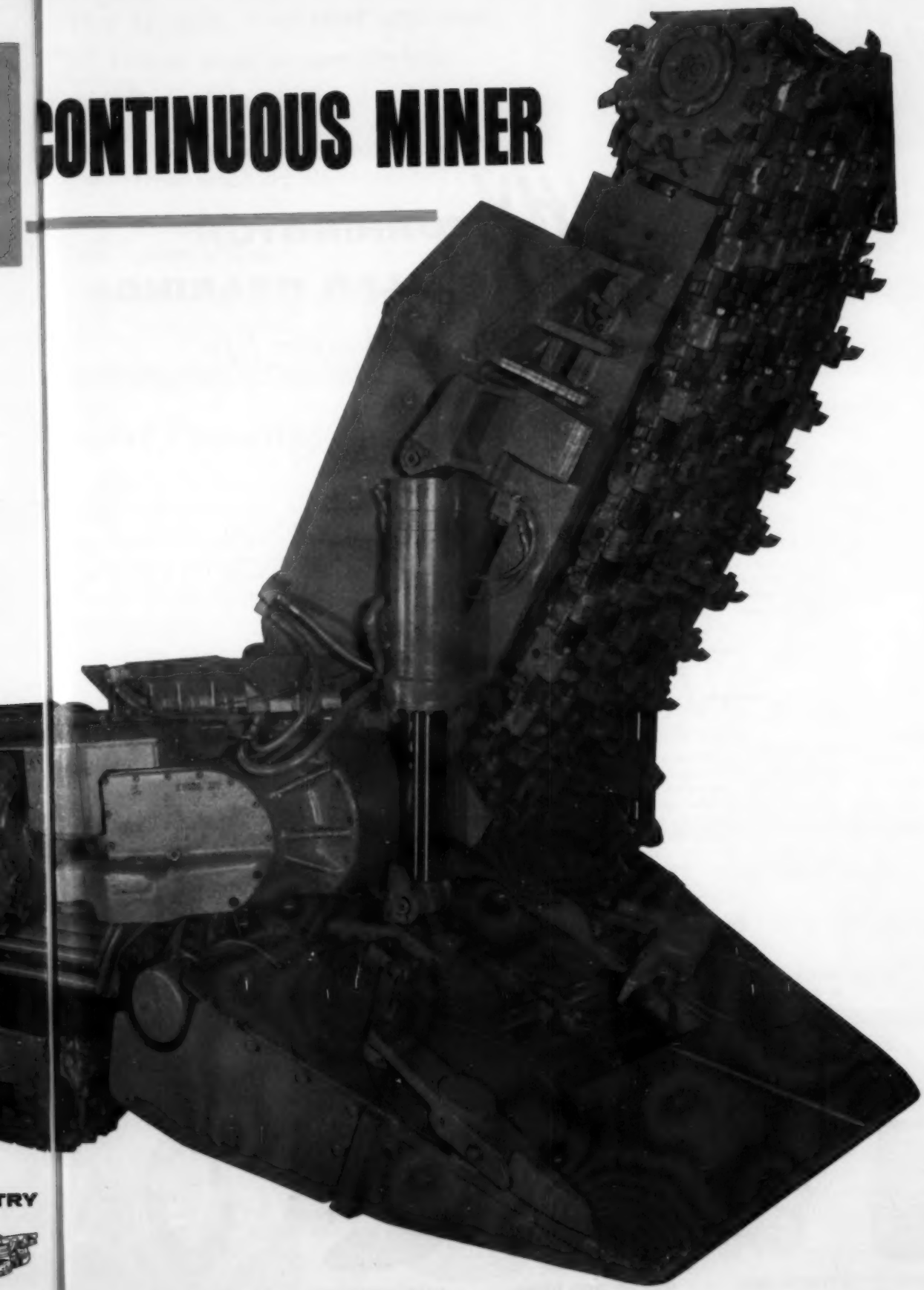
AC

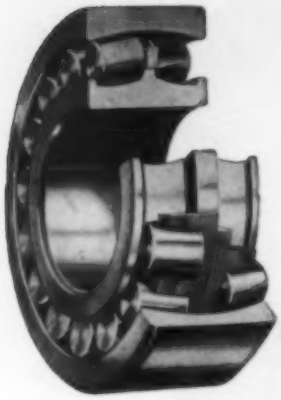
The new 6-CM is available with AC or DC.

JOY EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY

WBW C 7579-571

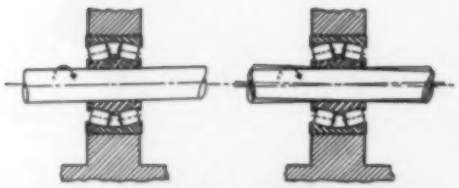
CONTINUOUS MINER



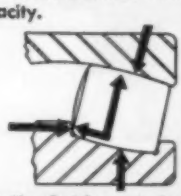


WHY TORRINGTON SPHERICAL ROLLER BEARINGS

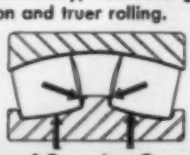
mean superior performance, longer life



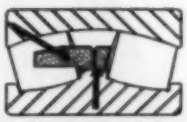
Self-Aligning Spherical Design allows compensation *within* the bearing for initial or dynamic misalignment up to 1½° in either direction and still maintains full radial and thrust capacity.



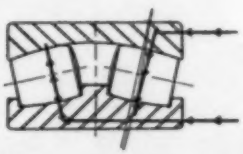
Positive Roller Guidance is doubly assured by the Torrington design: 1. Approaches the design of a true rolling cone. 2. Under load, the spherical roller seeks positive contact with the center guide flange because of its basically conical shape. This assures geometric stability, accurate guidance, lower friction and truer rolling.



Conformity of Precision-Ground Races to Rollers gives maximum load capacity and even load distribution. Optimum conformity of roller end to center guide flange prevents skewing.



Land-Riding Bronze Retainers, fully machined, operate with minimum friction. Each row of rollers operates independently under thrust loads without drag or side pressure from adjacent row.



Takes Thrust Loads. Angular design effectively handles end thrust due to load conditions, misalignment or other causes.

These are only a few of the features of Torrington Spherical Roller Bearings that make them your best buy for replacement needs. And for fast service, turn to your *Authorized* Torrington Bearing Distributor. He maintains complete stocks of Torrington bearings and can advise you on the latest installation and maintenance procedures. THE TORRINGTON COMPANY, South Bend 21, Ind.—and Torrington, Conn. District offices and distributors in principal cities of United States and Canada.

TORRINGTON BEARINGS

NEEDLE BEARINGS • CAM FOLLOWERS • HEAVY DUTY NEEDLE BEARINGS • ROLLER THRUST BEARINGS • NEEDLE THRUST BEARINGS

The simple, low cost answer to these coal preparation plant problems...

1. **Recovery of marketable coal fines from washing plant waste**
2. **Removal of solids from washery plant effluent**
3. **Reclamation of water in closed water systems**

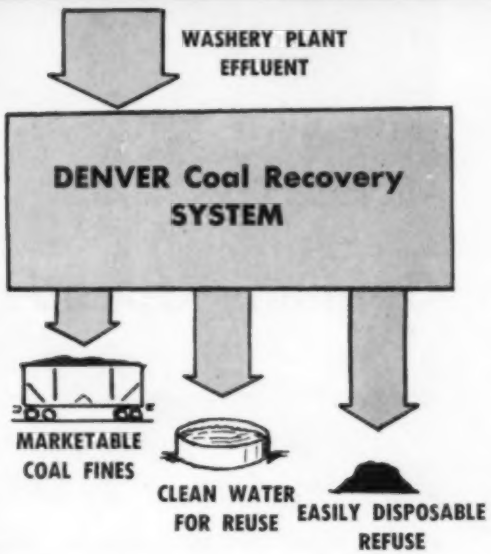
DENVER Coal Recovery SYSTEMS

SIMPLE • EFFICIENT • PROFITABLE

Since more fines are produced in mechanized mining, it is not economical to discard coal fines to waste even though ash contaminants may render these fines unmarketable without additional cleaning. Washeries faced with recovery of clean coal fines, removal of solids from plant water and providing a closed plant water system, now have a simple, low cost answer.

Whether you are confronted with any or all of these problems, DENVER can provide the answer with a simple, low cost system that will recover both coarse and fine, marketable, low ash coal from minus ⅛" down to 200 mesh and finer. A compact system that will reclaim water for reuse in a closed system—one that permits disposal of high ash washery waste without stream contamination—efficiently and profitably.

DENVER offers over 30 years of experience in designing and supplying coal washery plant systems. A complete service from testing to flow-sheet to equipment, installation and to profits. One source—one responsibility.



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COAL AGE

News Roundup

"ANDROS MARINER," 578-ft long steamship, loads up with 20,826 tons of coal headed for Europe. Whirlwind passage of German tariff to protect nationally-mined coal threatens the near-term possibility of overseas shipments from United States producers, many of whom have geared up to fulfill suddenly uncertain contracts.

Germany Upends '59 Exports

Staggering $4.76 per-ton duty on imported coal arouses a storm of angry protests from United States exporters and legislators alike. Washington files official protest against bill designed to aid German coal industry.

FACED WITH THE DILEMMA of large pithead stocks without the prospect of an appreciable rise in demand, the German government has clamped a $4.76 per-ton tariff on all but the first 4.8 million tons of imported coal for 1959.

The United States' share of this duty-free quota amounts to only about 4.4 million tons, a severe blow to producers who have West German orders over the next 18 mo judged to be about 35 million tons of coal.

It was estimated that imposition of the duty, which will more than offset the present laid-down price advantage which American coal has enjoyed (largely because of low dry-cargo rates) in certain areas of West Germany over Ruhr coal, could cut exports during this year by upward of 8 million tons. Since U. S. exporters have shipped an average of over 12 million tons of coal to West Germany in the past three years, this would amount to around 60% of coal's biggest overseas market.

Adding to the sharpness of the blow, it was announced that the act, which became effective Feb. 16, was to be retroactive to Jan. 1 insofar as the quota was concerned, meaning a substantial portion of the duty-free import limit had already been used up.

All this came as a surprise to coal men and legislators alike, not because the move seemed so impossible, but because Economic Minister Ludwig Erhard had always made much of free market economy without controls both at home and abroad. Here is how it happened:

Low Demand—Economists say that German coal output is not adjusted to the volume demand of the market. Blame falls chiefly upon lower-priced foreign-coal imports and cheaper-than-coal oil. However, it is estimated that there would still be an excess if no U. S. coal were imported at all this year.

Despite this unbalance, total output of coal in Germany through 1958 was up to around 132.6 million tons, only about 583 thousand tons less than in 1957. Chief reason is that despite mine managements' efforts to throttle output by dismissing men and cutting shifts, output per man-shift increased from 3,487 lb in 1957 to 3,612 lb in 1958. Result? Stocks kept growing—began to push towards the 14-million-ton mark resulting in cries for aid from miners and producers. Finally the clattering reached official ears.

Squares Away—When an embargo suggestion arose, as was bound to happen, Minister Erhard squared away against two problems:

1. Germany has long-term contracts with the United States for imports, and diplomatic policy worked against an embargo or other restriction, especially in the light of the economic aid, upwards of $13 billion, that the United States had extended to Germany since 1948. As Tom Pickett, National Coal Association executive vice president stated, it amounted to biting the hand that had fed you.

2. Mr. Erhard's own established policy of free economic trade.

The economic minister suggested various measures to cut stocks: A tax on German-produced fuel oil, selling more coal to the army and offering rebates to coal customers ordering and taking delivery of more coal than they consumed last year were a few. But under mounting pressure, Mr. Erhard finally announced that the government was faced with the drastic solution of a full embargo on coal imports under Clause 19 of the GATT treaty, but had decided to impose the duty on coal to avoid discrimination and prevent possible unfavorable effects of an embargo on other sections of the economy.

Whirlwind Action — Conrad Adenauer's Christian Democrats wasted no time in the lower house. On a show of hands and despite an official protest from Washington they rifled through the $4.76 tariff and set a quota on imported coal of only 3.5 million tons to be duty free. Under blistering attack from German importers and American coal interests, Bonn boosted the proposed quota

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several days later, but to only 4.8 million tons. This had little effect in soothing the ruffled feelings of U. S. exporters.

Bombardment—A rash of strong protests followed the action. John S. Routh, president of the Coal Exporters Association of the United States, Inc., called the West German tariff "stupid and prohibitive." "We believe the State Dept. should bear in mind that commercial contracts entered into in good faith should be just as inviolate as international agreements," Mr. Routh stated. "Press dispatches indicate that this action of the West German government has alarmed West Germany's partners in the European Coal and Steel Community and has drawn protests from German importers. . . . In my 40 yr in coal exporting I have never heard as much furor as this contemplated action is entailing."

Tom Pickett, National Coal Association executive vice president, said in a letter to John Foster Dulles, "This arbitrary unilateral action will effectively deprive the United States of about 60% of its largest overseas market for bituminous coal."

West Virginia Representative Cleveland M. Bailey was even more emphatic:

"What is happening is that the coal industry in West Virginia and other producing states is being throttled by a noose in the hands of a gang of international diplomats. . . . Our State Department policymakers go into a calypso every time they hear the beat of a Creole Petroleum oil drum."

Congressman Bailey also mentioned the large number of foreign automobiles being sold in this country, bringing unemployment not only to American auto workers, but also to coal, steel, glass, and all supply manufacturers. "If a tariff equivalent to the one announced by West Germany on American coal were imposed on foreign cars, you would hear our friends in Bonn and elsewhere screaming to high Heaven," Congressman Bailey concluded.

Many Angles—Diverging opinions as to whether or not the tariff is warranted marked developments following the imposition of the tariff. German coal owners welcome the new tariff as a necessary step to reduce their stockpiles. With competition from both imported coal, and possibly fuel oil (if a proposed 4% tax goes through), kept at bay, they feel they can employ efficient commercial methods to sell their production and reduce pithead excesses.

One expert holds, however, that U. S. coal competition is not a cause of German coal troubles. He compared metric-ton prices in five German cities for 6x35-mm U. S. and Ruhr nut at various long-ton ocean freight rates and found that U. S. coal is not competitive, at least pricewise. This agreed with several other opinions that Ruhr coal is competitive in all but the distant coastal areas.

Undercuts Oil—German coal importers provide another slant. They insist that prices for U. S. coal are below those for German coal and that U. S. coal by its price is better equipped to compete with fuel oil, thus has only taken from German coal those German coal users who would have otherwise shifted to fuel oil.

The Picture—In summary the tariff could have this effect. Cancellations in 1959 could keep about 8 million tons of U. S. coal off the German market. Including cancellations during 1958 this will leave about 6 million tons of U. S. coal under contract for delivery to Germany in 1960, with forfeit rates running possibly up to $7 a ton.

The long-term picture is fairly clear. Most economists predict that growing needs in the European power market will provide an improving market for American coal. For the present, many authorities feel that in the light of the past and our strong ties with Germany, existing firm contracts will be fulfilled. Others, however, call attention to Minister Erhard's statement that the affair has gone too far to stop, saying that forfeit rates will probably be paid. Thus, the near-term coal exports picture is clouded by a great many ifs.

Pa. Mine Flood

State conducts full investigation of disaster.

As of Feb. 25 workers hadn't found the bodies of the 12 men trapped in the Knox Coal Co. flood of Jan. 22 and rising levels of the underground deluge were threatening more mines in the area. Also at that date, the Luzerne County, Pa., District Attorney's office was toiling along with a state committee and the Federal Bureau of Mines to uncover the cause of the disaster.

The flooding began when a hole developed above one of the firm's slopes permitting the swollen, raging Susquehanna River waters to pour through, trapping the miners.

Fifty-two men were working in the shaft when the breakthrough came but only 40 were able to scramble through mud and icy waters to the mouth where they were pulled to safety.

Billions of gallons of water continued to flow through the 75-ft hole filling some shafts almost to the top and spilling over into interconnected workings. Over 50 mine gondolas, along with everything else big available—telephone poles, trucks filled with rocks, tractors, straw and coal, were dumped into the maelstrom around the hole but were swallowed up at first by the turbulent waters.

The hole was finally filled, but only after water estimated by the Federal State Flood Forecasting Service to be around 40 billion gallons had swamped the mine placing other connected mines north and south of the disaster in danger of flooding.

Fast Aid—President Eisenhower declared the location a disaster area, and working quickly, Gov. Elect David Lawrence of Pennsylvania prepared a bill asking the state for $2,500,000 to buy pumps to dewater the mines. As we went to press pumps rated at 1,000 hp which suck out as much as 4,000 to 5,000 gpm were working along with smaller pumps round-the-clock, to lower the water level in the shafts.

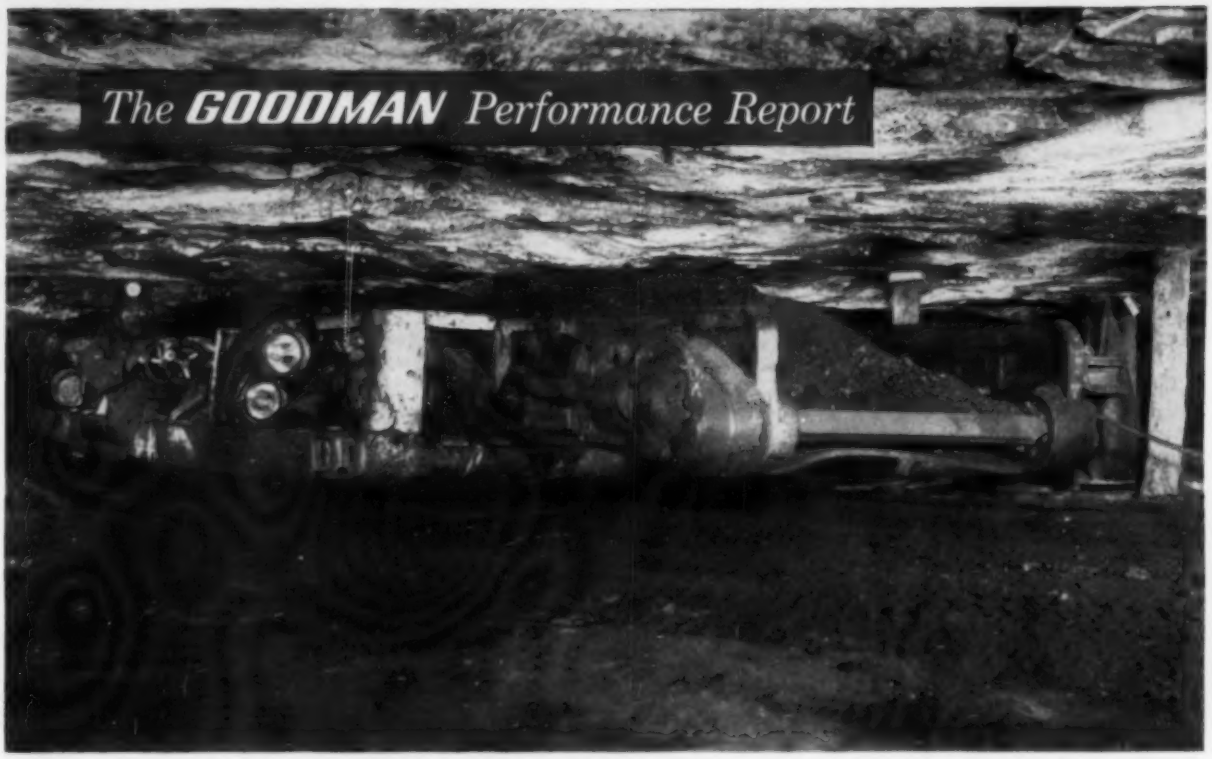
But the job is huge and could take several months according to engineers' calculations. The task not only entails removing the water from the various levels, but also the work of reinforcing and retimbering each section as the water recedes in the operation. When water is removed from the vein nearest to the surface then that section will have to be put in a safe condition before the second level can be tackled.

Probe Cause—Along with the State mine disaster bill asking for funds for the area went plans for an investigation of the disaster. The investigation plans were immediately approved by the Pa. State Senate and a special 10-man committee chosen with five members of the State Senate and five appointed from the House. Both Governor Lawrence and Secretary of Mines Joseph Kennedy said they welcomed the probe to determine the exact cause of the flooding. Mr. Kennedy told Gov. Lawrence that state mining laws are "antiquated as far as they deal with modern methods and machinery now being used in the mines."

Favor Oil Curbs

The Office of Civil and Defense Mobilization told government oil imports threaten national security.

Of 30 interested companies and associations questioned recently concern-



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You get full-time efficiency from these big-little cars. All motors are rated 10 h.p. . . . Goodman designed and built with a high continuous rating for full-time peak performance. All use identical and interchangeable motor shells and armatures. The armatures last so long in hard service that one mine with four Goodman cars in operation since 1951 has yet to have one rewound. Another mine with 12 cars in service six years, has replaced only one set of coils.

Most important, the 870 carries a man-size pay load. A prominent low vein mine reports one Goodman to each 3-ton mine car—not three shuttle car loads to two mine cars as required where other makes are in use.

And for ease of handling, particularly in close quarters, the 870 can't be beat. 4-wheel power steering and disc type brakes greatly reduce operator fatigue and promote safety. Other standard Goodman features include 4-wheel positive drive for rough going, dual control in operator's cab, adjustable height discharge and U.S. Bureau of Mines Approval.

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ing imports of crude oil, only two took a clear stand against restrictions. These results came out of a reinvestigation of the national security threat posed by imports, prompted by increasing demands for mandatory oil quotas.

The Office of Civil and Defense Mobilization has been working to show legal reason for new restrictions, basing their work on the inadequacy of the old methods used.

The National Coal Association and the Independent Petroleum Association of American have been leading the fight to restrict oil imports. NCA formally called on the government on Feb. 12 for mandatory controls, telling officials that electric utilities and industrial plants along the eastern seaboard have a "built-in vulnerability" because of their increasing dependence on imported residual fuel.

If this supply were cut off by a blockade or other methods, declared NCA, a demand of 150 million additional tons of coal would be created which the coal industry might not be able to meet if weakened further by competition from foreign oil.

General feeling after the government survey seems to be in favor of stronger curbs on oil imports. Howard C. Pyle, president of the Monterey Oil Co. speaking on Feb. 15 at a meeting of the American Institute of Mining, Metallurgical and Petroleum Engineers, predicted that mandatory controls would be imposed early this month.

NCA suggested that if there is further delay in imposing mandatory restrictions on imports of crude oil and derivatives, residual oil should be singled out for mandatory quotas. As we went to press reports indicated possible passage of mandatory curbs by March 1.

Quiet Bickering With a Good Neighbor

United States coal interests, anxious to get a slice of increasing Canadian power needs, believe their northern neighbor should not expand coal subsidies nor undercut American supplies.

With part of the St. Lawrence Seaway operating and more channels opening shortly, the Canadian coal picture has been stirring up more interest among American coal producers.

For the present Canada's coal situation is bleak. Consumption for 1958 was down around 25 million tons—the lowest since 1939. Stocks are pushing well into the millions and over 4,000 miners were idle early in 1959.

Recently the Canadian Parliament suggested as a remedy raising the present subsidies granted Canadian coal in the form of "subventions" by which the government pays part of the freight charges. Some of these subventions now run up to $5.80 per ton, and in one instance more than $9, reports the National Coal Association, which has urged congress to protest increased Canadian subsidies.

Exports Down – Representatives of NCA explained to the State Dept. that Canada has been a large consumer of U. S. coal as some American fields are close to the Ontario and Quebec industrial centers. Exports to Canada, NCA noted, have decreased sharply under the impact of subventions. [Shipments to Canada were about 20.5 million tons in 1956. Drops of 2 million tons in 1957 and about 6 million in 1958 were experienced—Ed.]

Also criticized by NCA were Canadian trade barriers. Canada imposes a duty averaging 35c per ton on U. S. coal while Canadian coal enters the U. S. duty-free. If Canada expands its subsidies, NCA spokesmen suggested, the U. S. should impose identical trade restrictions on shipments of Canadian energy to the U. S.

Canada's Problems – The Canadian coal industry was hard hit by the generally depressed 1958 economy, especially because it came at a time when it was still readjusting to the impact of big oil and gas expansion as well as tremendous railway tonnage losses resulting from dieselization—from 13 million tons in 1952 to only 2 million in 1958.

With construction of the Trans-Canada pipeline completed, the year ahead looks rough and uncertain to Canadian coal men because gas is invading the great central, highly industrialized region of the country, often at prices gaged to obtain volume for the pipeline even if sales have to be below cost. Thus Canada's coal industry feels that the situation is approaching the climax stage.

Seaway Ifs—The new seaway presents problems for many Canadian coal producers. Key question is—will reduced shipping costs for Nova Scotian coal compare favorably with lower rates granted U. S. coal moving from the Great Lakes region? This question mark is believed to be the key reason the Canadian Parliament is toying with the idea of higher subsidies.

The Future—Despite all, Canadians see some encouraging signs. Industrial consumption has been fairly steady, reaching its peak in 1957 and dropping only about 1.8 million tons in 1958. Even that drop can probably be attributed to a mild winter and abnormal hydro power because of high water levels.

Recovery hopes are based largely on these factors:

1. The Japanese steel industry has been taking a hard look at British Columbia and Alberta coal. Japan is also considering Canadian coal for making artificial gas.

2. A Canadian government directive recently increased the preference to be given to Canadian coal in federal government purchasing to 20%.

(*Continued on p 41*)

ON THE JOB at Chafin Coal Co., Logan, W. Va., are (left to right): Front row—W. Marcum, mine foreman; C. E. Wison, outside supervisor; K. H. Hall, section foreman. Rear row—A. H. Sellards, fire boss; Oscar Damron, general superintendent; M. Browning, E. H. Doty Sr., and Paul Maynard, section foremen.

No. 12 in a series

Right off the Wire

1. A new teletypewriter can print 3,000 words a minute and has a theoretical top speed of 500,000.

2. Work has begun on a pilot model of a device for generating electricity from the controlled fusion of hydrogen at a temperature of about one hundred million degrees.

3. A new industrial pump has a piston that moves only a fraction of an inch, but at the rate of sixty cycles per second. It has no outside openings and cannot leak.

4. The "world's first" atomic house heating installation is being built underground in a suburb of Stockholm.

5. "Hydrogasification" is a one-step process that produces gas directly from oil shale with an efficiency of over ninety per cent.

6. A radar target made for small boats reduces the risk of their being run down by large vessels and also makes it easier for them to be found when in distress.

7. Heat radiation in amounts as small as one-twentieth of a billionth of a watt can be detected by a new instrument.

8. A traffic signal on wheels is battery operated and can be set up anywhere.

9. Tire treads made of a new synthetic rubber are said to be forty percent more durable than those made of natural rubber.

10. Power is transmitted to two of the world's largest coal-digging machines through 3 conductor, 7500-volt, Simplex TIREX shovel cables.

11. One hundred and twenty-five skilled workers will be replaced by a new automatic tester for transistors which will also make fewer errors.

12. A new metal-working plant will be air-tight and metals will be fabricated at high temperatures in an atmosphere of argon.

13. A three-dimensional mobile radar shows the direction, distance and height of aircraft.

14. A battery charger for outboard motors uses the generator of the towing car while the boat is on the trailer.

15. Earphones that cancel outside noises by creating neutralizing sound waves are being used experimentally by the Army.

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

16. Homes may be lighted, heated and cooled electrically by means of a type of panel now being developed.

17. A reading aid for the blind translates each printed letter into a different musical note.

18. An underground hospital is to be built which will have 650 beds. It is to be completed in 1960.

19. Molten sulphur will be pumped up from a depth of 2,000 feet under the floor of the Gulf of Mexico. The installation is being made seven miles off the Louisiana coast and the liquid will be pumped to shore for refining.

20. New gallery-type railroad passenger coaches and parlor cars are being used for medium-haul service. The bi-level streamliners, designed for high capacity and low weight per seat, use Simplex Car Wire throughout.

21. Growing under artificial sunlight, a new strain of algae multiplies a thousandfold in a day.

22. Fungi may have been the first living space travelers. It has been found that some spores can exist in a vacuum equal to that in interplanetary space.

Transatlantic Concert

One of the most notable musical events of all time took place recently at the United Nations building in New York. The concert, featuring the Boston Symphony Orchestra and distinguished musicians from Paris and Geneva, was highlighted by the performance of Pablo Casals, world-famed violincellist. This epochal musical treat was telephoned to seventy-five countries by the Bell System, over the transatlantic submarine cable, the American portion of which was made by Simplex.

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People in Coal

Honored For Maintenance

W. E. McCLAIN, selected as "Maintenance Man of the Year" by the Mining Electro-Mechanical Maintenance Association, is the senior maintenance engineer of United States Steel's Frick District. His responsibilities include both line and staff duties in coordinating maintenance at the company's Robena mines, Greene County, Pa.

He directly supervises Robena's Colvin shaft machine shop, Bowlby overhaul barn, the locomotive repair shop and the mine-car repair shop. Also in his line of duty is direction of personnel in maintenance of all surface facilities.

At the maintenance shops equipment receives complete overhauling and rebuilding with repair of assemblies and component parts also accomplished. Activities are concentrated on continuous miners, shuttle cars, loading and cutting machines.

Mr. McClain's staff responsibilities entail scheduling of equipment overhaul and unit replacements as well as installation and refinement of periodic inspection programs.

He has been with Frick District mines since 1942, holding positions of machine repairman, electrician at Leisenring No. 3, and mine electrician at Leisenring No. 1 and 2. He served as master mechanic and general maintenance foreman at Karen mine prior to his appointment as senior maintenance engineer, August, 1957.

Mr. McClain is married to the former Thelma Hayden of Newcomer, Pa. They have three sons and a daughter.

Henry F. Hebley a research consultant associated with Consolidation Coal Co. for nearly 20 yr, has retired. Mr. Hebley, born in New Zealand in 1893, engaged in copper mining in Australia before coming to the United States to continue his work in Utah and Arizona. He joined the Pittsburgh Coal Co. in 1939 as product-control manager and became director of research a few years later. When Consolidation Coal Co. was formed he was appointed research consultant in charge of reducing air and stream pollution. Mr. Hebley plans to remain in Pittsburgh and continue his consultant work on these problems as they relate to the coal industry.

The Indiana Coal Preparation & Utilization Society, met recently to organize for the coming year. New officers and directors elected were: **Richard Mullins,** Enos Coal Mining Co., first vice-president; **Robert Humphreys,** Sherwood-Templeton Coal Co., second vice-president; **Carl Donie, Faryiew Collieries** Corp.; and secretary-treasurer, **Senour B. Richey,** The Maumee Collieries Co., Terre Haute, Ind. Directors: **Edward Greenwood,** The Maumee Collieries Co.; **T. R. Hightower,** Ayrshire Collieries Corp.; **Robert Houser, Commercial Testing & Engineering Co.; Nathaniel Kirk,** Snow Hill Coal Corp.; **David Lee,** The Maumee Collieries Co.; **Max A. Matthews,** Templeton-Matthews Corp.; **J. B. Matthews,** Rose Polytechnic Institute; **George H. Morris,** Peabody Coal Co.; **Robert M. O'Rear,** C. F. Gharst Supply Co.; **Robert Potter,** Hewitt-Robins, Inc.; **John E. Singhurse,** Shasta Coal Corp.; **John Stachura,** Enoco Collieries, Inc.; **R. B. Thomas,** Indianapolis Machinery Co; and **Charles E. Wier,** Indiana Geological Survey.

General superintendent, John L. Schroder of The U. S. Steel Corp., Lynch, Ky. has just announced the following promotions: **James R. Carter,** industrial engineer, No. 32 mine at Lynch; **John L. Smith,** to assistant mine foreman, the No. 32 mine; **Aaron Creech,** to shop foreman, No. 31 mine, Lynch; **J. C. Cuzzart,** to assistant mine foreman, No. 31 mine; **James R. Stewart,** to construction engineer with offices in Lynch.

John M. Jex, former administrative assistant to Sen. Arthur V. Watkins (R-Utah), joined the staff of the National Coal Association on Jan. 1. Mr. Jex was educated in Salt Lake City and obtained a law degree in 1949 from the University of Utah. He was a sergeant in the 66th Infantry Div. in World War II.

Samuel P. Carter was promoted to chief engineer of Armco Steel Corp.'s

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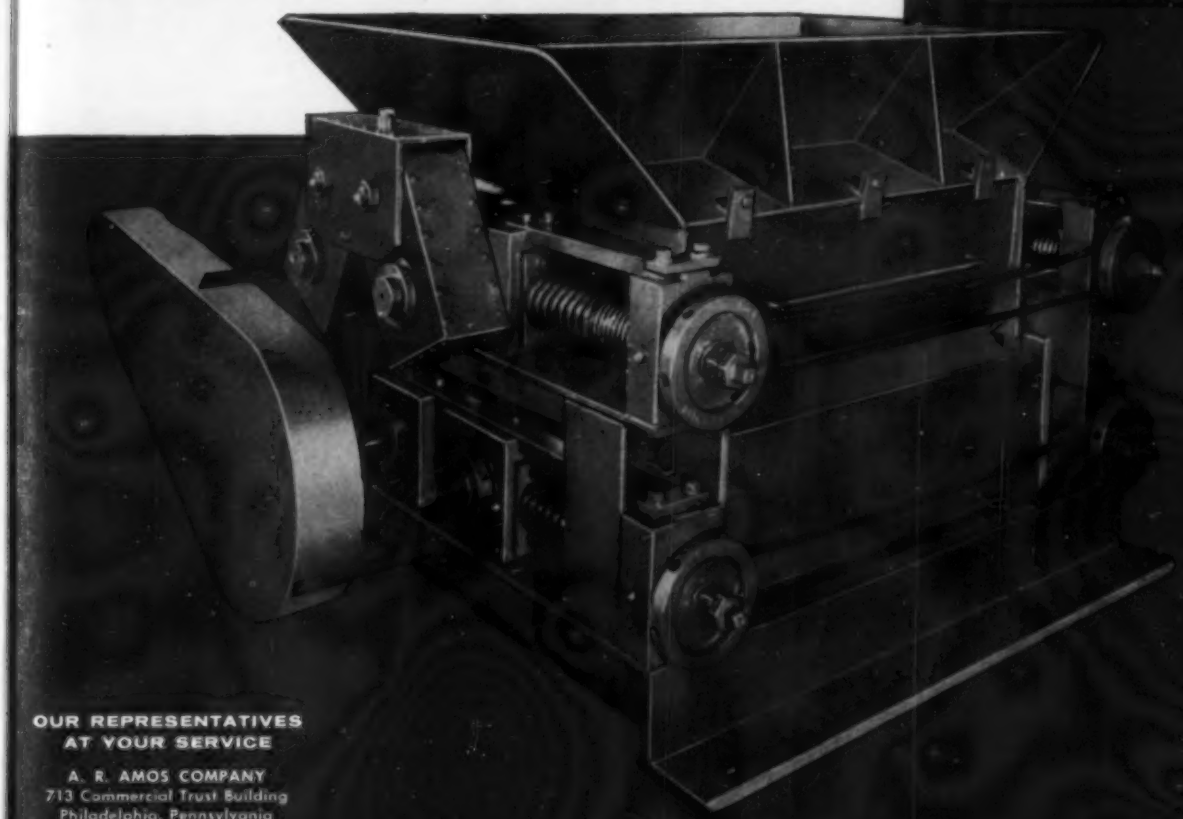

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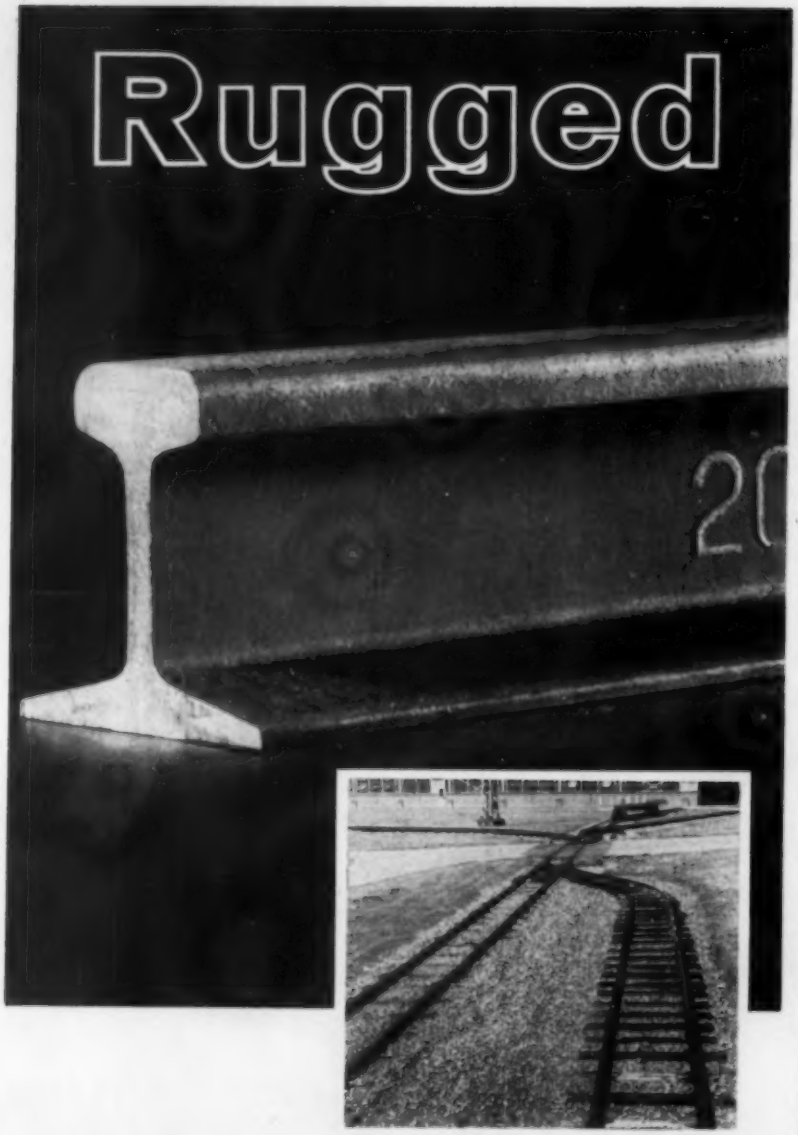

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People in Coal (*Continued*)

West Virginia coal mines. Mr. Carter studied electrical engineering at Virginia Polytechnic Institute after attending William and Mary College. He joined Armco in 1934 as an electrician at the firm's Nellis, W. Va., mine.

David G. Werner took over the duties of maintenance engineer for Pittsburgh Coal Co., subsidiary of Consolidation Coal Co., on Feb. 1. Mr. Werner, whose office will be at Library, Pa., joined Pittsburgh Coal in 1936 as an apprentice at the Library shops. After holding several positions with the firm he was placed in charge of the Mathies preparation plant in 1949, a position he retained until this new promotion.

John Kristoff became superintendent at Oakmont mine of Harmor Coal Co., operating unit of Consolidation Coal Co. Mr. Kristoff joined Pittsburgh Coal Co. in 1937 as a miner at Midland mine. After serving in the Army during World War II he attended W. & J. College graduating with a BS degree in 1949. While going to college he worked part time at Westland mine and was appointed assistant foreman in 1951. He was made mine foreman at Montour No. 4 in 1955, working in that position until assuming his new duties.

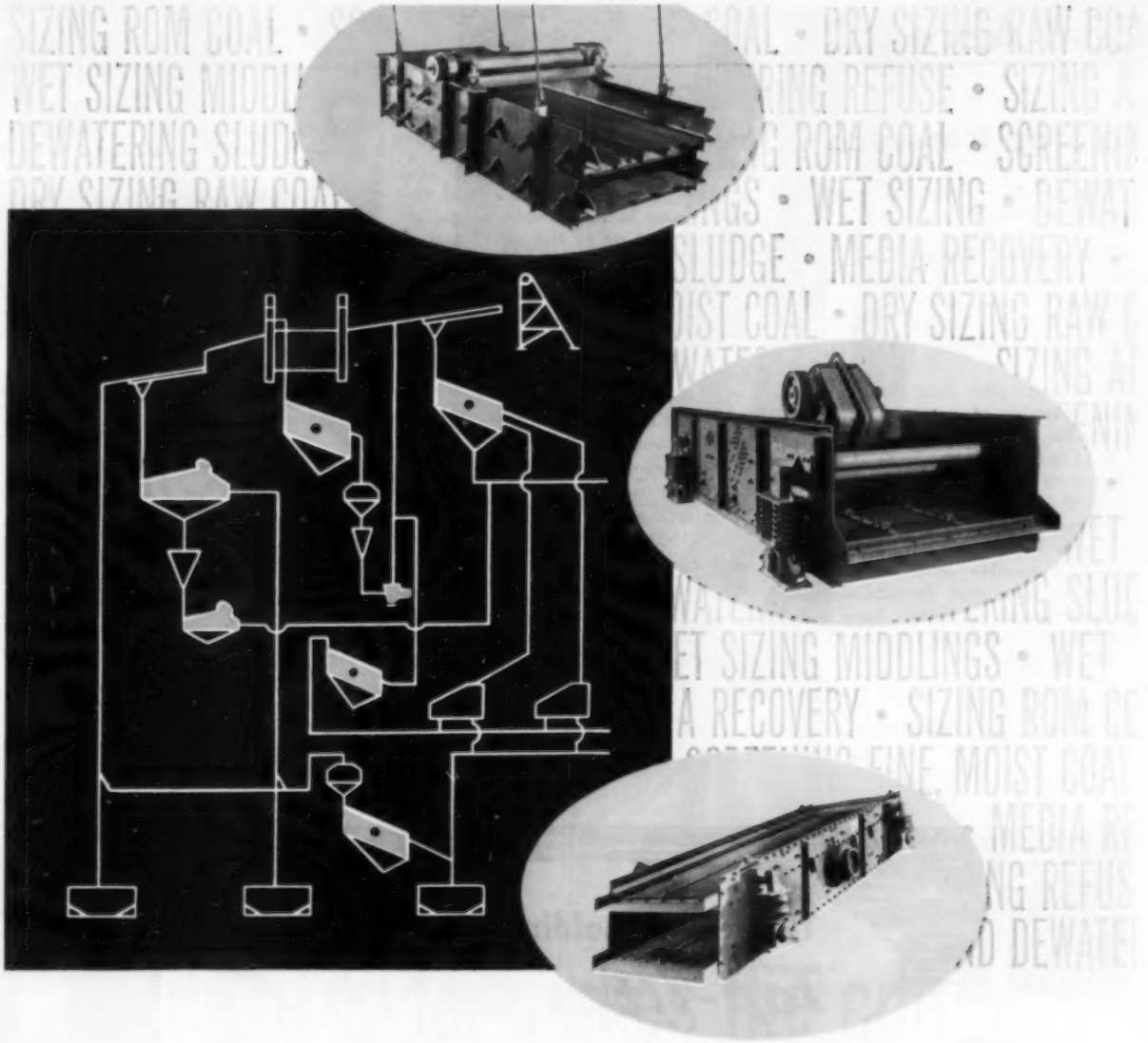
Donald E. Hartman has been named general manager of the Pennsylvania Coal & Coke Corp., Div. of Penn-Texas. He succeeds **Thomas L. Aitken** who retired after 45 yr in mining.

Dr. Frank Thomas, formerly a dentist, has given up his practice to become general manager of the Stearns Coal & Lumber Co., succeeding **R. W. Henderson** who retired after about 50 yr with the firm. The company operates mines at Blue Heron and Cooperative, Ky.

Obituaries

C. C. Dickinson Jr., 53, well known in the coal industry of West Virginia, died Jan. 14 in Tucson, Ariz., where he had gone for health reasons. He was vice president of the Dickinson Fuel Co., a past president of the Kanawha Coal Operators Association, and had been a director of the Southern Coal Producers Association.

Earle Snarr, 60, veteran figure in mining, died recently at a Chicago hospital. A resident of Franklin County, Ill., where he had been general superintendent of Chicago, Wilmington and Franklin Coal Co. mines, he had lived in Hinsdale since 1955 when he was named vice president in charge of production for the Freeman Coal Co. mines.



A Screen for EVERY PURPOSE

In Coal Preparation

Allis-Chalmers makes it easy for you to choose the most economical vibrating screen for *any* coal processing need. That's because A-C builds a screen for *every* coal application, and they're all systematically classified in our helpful screen selection guide, free on request.

For example, if you need a screen for sizing fine, moist coal, you'll find an Allis-Chalmers screen specifically designed for the job. "Complete line" availability is one of the reasons more A-C screens are used in coal than any other make.

Ask your nearby A-C representative for your copy of Bulletin 25B6280, containing valuable screen selection guide. Or, write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-5870

Coal Abroad

To Stop Research

Britain finds underground gasification experiments too costly.

Great Britain's National Coal Board will call a halt to its experiments in underground gasification of coal this summer, having decided commercial prospects do not justify further expenditure.

The Board's pilot plant has produced small quantities of gas by ignition of uniminable coal seams. The gas was used to generate power from a temporary station on the site.

The Board makes it clear however, that more research is not justified only insofar as Britain's fuel needs are concerned. A number of other countries known to have coal deposits suitable for underground gasification have made inquiries about adapting the process, according to reports.

OVERSEAS FLASHES

USSR—A new-type mechanical coal combine at work in Russia's "Red October" mine in the Donbass region reportedly cuts up to 100 metric tons of coal per 24-hr period at a seam height of less than 14.43 inches. The machine was designed for very small excavations where miners cannot even crawl to the work face, and operates on remote control.

EAST GERMANY—Plans here call for increased output of lignite. East German coal men project the need for 228,500,000 metric tons of lignite during the German Democratic Republic's Five-Year Plan (1960 to 1965). Ninety percent of East Germany's caloric power, it is reported, will stem from lignite-fueled plants. Claiming to be the leader in the European percapita quota in electric power production, the East German grid is to be supplied with 38.3 million kwh during the next 5 yr, add the reports.

AUSTRALIA—Japanese steel mills have signed contracts for 3 million tons of Australian coal to be supplied during the next 5 yr. Commenting on the Japanese order, the Southern Colliery Proprietors' Association of New South Wales said the highly-mechanized south-coast mines in the New South Wales were currently producing coking and steaming coal equal to the best in the world.

AUSTRIA—This nation's coal consumption during the first 9 mo of 1958 was 5,656,274 metric tons, 14.7% less than recorded for the identical period of 1957. The warm winter, the shortage of money which forbids the forming of capital-blocking stockpiles at industrial enterprises and increased use of other fuels are cited as sales deterrents.

Talk about holding power...
"Top-Tite's" GOT IT!
Here's what bolting people have been looking for!
A STEEL SHELL that leads the way in...
HOLDING POWER—TIGHTENING SPEED
—RELIABILITY
"TOP-TITE" has fine grooves instead of saw teeth for better, more even distribution of the bolt load. And the jumbo-sized plug makes sure the broad leaves stay against the hole wall... no leaf curl-in. And for speed of tightening—just ask a crew that's switched to "TOP-TITE".
Have you had trouble with plug pull-out... leaf breakage... misalignment? Instead of merely lessening these problems, "TOP-TITE" eliminates them. Call or write us today!
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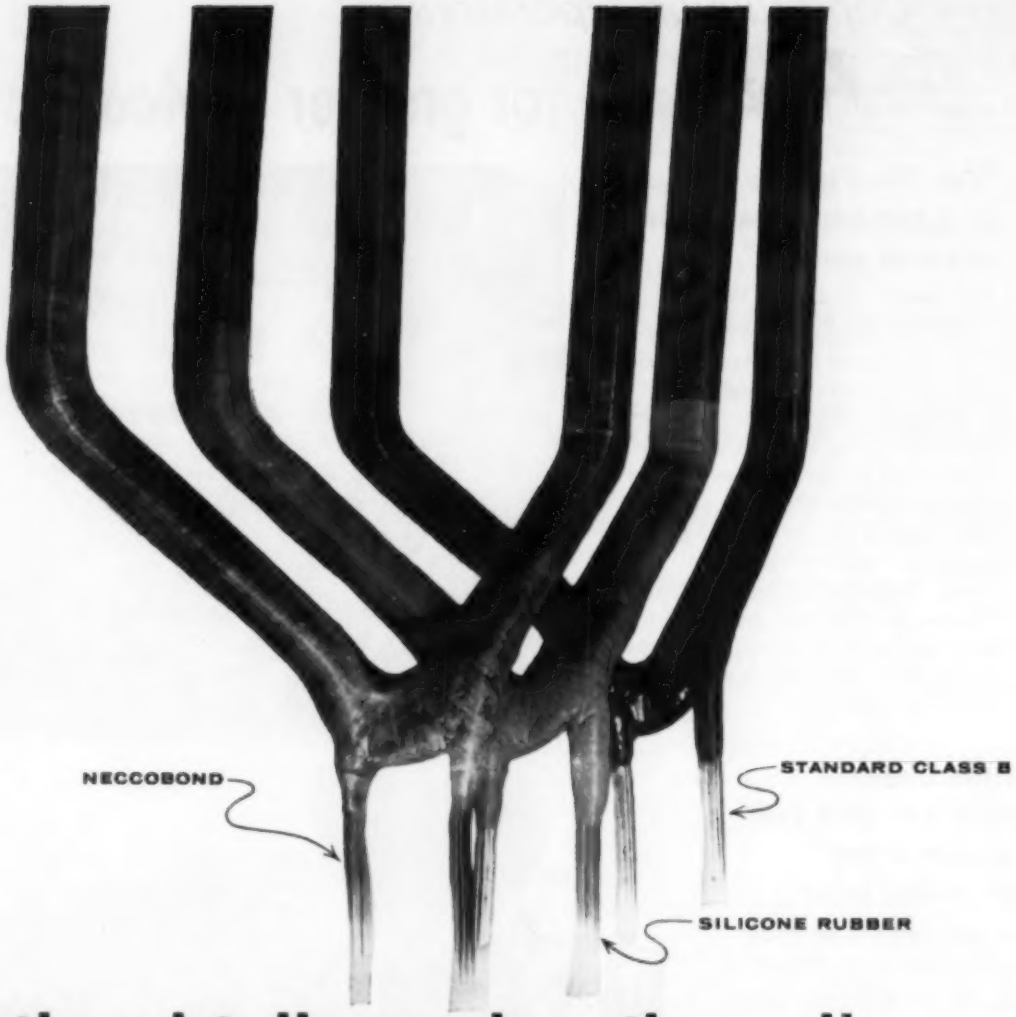

National tailor-makes the coil to fit your application

These generator stator coils symbolize the full range of coil insulations offered by National Electric Coil. Since NATIONAL either *makes or uses all types* of insulation, our recommendations are based solely on the requirements of your application.

Here's the range of insulation systems NATIONAL offers:

- All Standard Class A, B, and H
- Silicone rubber
- Mica and glass combinations impregnated with catalytic type resins such as epoxies, polyesters and blends.
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You'll find it pays to deal with National.
Call or write for full information on our services.

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DIVISION OF McGRAW-EDISON COMPANY

COLUMBUS 16, OHIO

ELECTRICAL ENGINEERS • MANUFACTURERS OF ELECTRICAL COILS, INSULATION, LIFTING MAGNETS • REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

Heavy Construction Operators

GO FORD-WARD for greater payload... power...

"Our Ford trucks haul up to a ton-and-a-half more payload per trip"

says William R. Collins, V.P.
William Collins and Sons, Fargo, N.D.

"We switched to Ford trucks in 1951 because we found we could haul 1½ tons more per trip. Now we have 124 Fords, including 80 T-700's. They're economical to operate, too—we get up to 6 miles per gallon. Our drivers like Ford's power steering and peppy 302 HD V-8 engine. We like Fords because we know we can always get Ford parts quickly if we need them. That means our trucks aren't down over one day, even on a major overhaul."

"We trade every two years and find that Ford trucks bring highest resale price"

says John McCormick, Sec.-Treas.
Northern Improvement Co., Fargo, N.D.

"We keep our Ford T-700's in top condition year round, and it pays off. We get a higher resale price when we trade every two years. Fords have the ability to perform under the rugged conditions in our work. Power steering on our tandem dumps makes them easy to handle on-or off-the road.

"Our drivers like Ford's power . . . they get heavy loads under way fast"

says George C. Wilson, General Superintendent
Schultz and Lindsay Construction Co., Fargo, N. D.

"Ford's HD power in our T-750's gets heavy loads under way fast . . . helps keep us on schedule. And we can haul bigger payloads doing it . . . up to a yard more, legally, every trip. We've never had frame trouble either. They're rugged, durable trucks and if we ever need Ford parts, we can always get them at the nearest town."

FORD TRUCKS COST LESS

LESS TO OWN... LESS TO RUN... LAST LONGER, TOO!

er . ..resale value!

NOW!
CERTIFIED PROOF
FORD TRUCKS
COST LESS

All tests conducted and results
CERTIFIED
by America's foremost independent automotive research organization*
*NAME AVAILABLE ON REQUEST
Send inquiry to: P.O. Box 2687 Ford Division, Ford Motor Co. Detroit 31, Michigan

'59 Ford Pickups Win Economy Showdown U.S.A.

—average 25.2% better gas mileage!

Impartial tests of the 1959 pickup models of all six makes prove conclusively that Ford's ½-ton pickups equipped with Short Stroke Sixes are the economy champs for '59.

HOW TESTS WERE MADE

Standard six-cylinder models of the six leading half-ton pickups first were put through exhaustive road trials. All '59 trucks—Ford and competitive—were bought from dealers, just as you would buy them. After at least 600 miles break-in, all were brought up to manufacturer's recommended specifications.

The trucks were then tested—by America's leading independent automotive testing firm—at constant speeds of 30, 45 and 60 miles an hour. Next came stop-and-go tests, ranging from moderate city traffic to normal retail delivery operation. Acceleration rates were carefully timed in each gear to insure accurate results for all makes.

HOW NEW '59 SIXES RATE IN GAS MILEAGE						
'59 FORD SIXES GIVE	25.2% more miles per gallon than Make "C"	31.1% more miles per gallon than Make "I"	9.6% more miles per gallon than Make "G"	42.6% more miles per gallon than Make "D"	22.0% more miles per gallon than Make "S"	25.2% more miles per gallon than the average of all makes

The '59 Ford Sixes, *in every test*, averaged more miles per gallon than every other make! Combining all tests, the '59 Fords led the average of all other '59 pickups by 25.2%.

WHAT'S THE SECRET?

How can a '59 Ford Six make four gallons do the work of five in other trucks?

First, of all pickup Sixes, only Ford has modern Short Stroke design. This new type of engine is basically far more efficient than long-stroke Sixes of other pickups. Example: Ford's Six delivers more usable horsepower than any other pickup Six.

Second, to this modern engine Ford has added a new economy carburetor. By metering fuel more precisely in both low- and high-speed ranges, Ford's new carburetor boosts gasoline mileage in every type of driving. And Ford's *Economy Carburetor is standard at no extra cost.*

Your Ford Dealer now has the complete report of Economy Showdown U.S.A. Why not call or visit him today and get the whole story firsthand?

CUMM

MINING

MACHINERY

EXHIBITION

News Roundup *(from p 30)*

3. Nova Scotian coal has begun penetrating Ontario where it has been taking a back seat to oil and gas.

4. More thermal electric plants have been planned to result in new demand for coal.

On balance, both United States and Canadian interests are trying hard to work out a solution beneficial to both countries. With each side feeling they have equally valid economic reasons, bickering between two good neighbors may go on for awhile.

Hit Electrical Peak

A milestone in electrical output capacity was reached in January when a single steam-electric turbine-generator unit of the Detroit Edison Co.'s River Rouge plant produced in excess of 340,000 kw for about 24 hr.

A single Foster Wheeler natural-circulation steam generator, fired by pulverized bituminous coal, supplied 2,300,000 lb of steam per hr. It produces one kilowatt-hour from less than ¾ lb of coal, giving it an efficiency rating over 90%.

All major equipment exceeded design capacities. The Foster Wheeler steam generator designed for 2 million lb per hr, 2,725 psi and 1050/1000 F, exceeded this by 300,000 lb per hr. The turbine, built by Allis Chalmers, carries a nameplate rating of 320,000 kw but developed 341,000 kw.

Major Acquisition

Island Creek Coal Co. has acquired mining properties and leaseholds of Guyan Eagle Co. and Elk Creek Coal Co.

The move was announced by R. E. Salvati, president of Island Creek, and T. E. Hollandworth, president of Guyan Eagle and Elk Creek. An Island Creek spokesman said cash was paid, but the amount was not disclosed.

The properties acquired are mines No. 1, 4 and 5 of Guyan Eagle and mines No. 1 and 4 of Elk Creek, all in Logan County, W. Va. Included are about 30,000 acres of land in southern West Virginia.

All mines are served by the Chesapeake & Ohio Ry. and have an annual productive capacity of 4 million tons. In 1957, Guyan Eagle-Elk Creek operations produced and sold about 3,800,000 tons, according to reports.

Mines, Companies

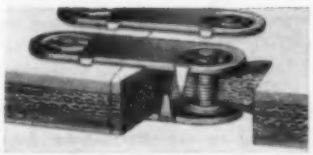
The last of the big mines in the St.

NO BELT SPLICING PROBLEMS HERE...THEY USE

FLEXCO® FASTENERS!

(PHOTO TAKEN AT PEABODY COAL CO., MINE #10, PAWNEE, ILL.)

Tight production schedules require dependable belt fasteners!



Cutaway of a Flexco application showing the compression plates, teeth and precision-made bolts and nuts.

Daily, the thousands of "working" belt splices throughout the country are proving the superior holding power of FLEXCO joints (no other belt fastener is so widely used). Belt maintenance crews like to work with Flexco fasteners because they are easy to apply—joints last a long time — worn plates can be replaced quickly—ideal for repairing rips and tears.

PROTECT YOUR INVESTMENT IN CONVEYOR BELTS WITH FLEXCO . . . the quality fastener for all heavy-duty conveyor belt applications: COAL & METALS, SAND & GRAVEL, CRUSHED ROCK, CONSTRUCTION EQUIPMENT, etc.

Available in Steel, Monel, Stainless, Everdur. Also Promal top plates.

FLEXCO "25-PAK"

"25-PAK" contains enough fasteners to join common belt widths.

ORDER FROM YOUR DISTRIBUTOR, OR WRITE TO US FOR BULLETIN F-112.

"FOR THE SPLICE OF A LIFETIME"

Flexible STEEL LACING COMPANY

4638 LEXINGTON STREET • CHICAGO 44, ILLINOIS

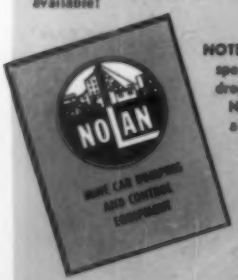
BIG OHIO-PENN-W. VA. COAL COMPANY operating a total of 53 NOLAN PORTA-FEEDERS *orders 5 more!*

Repeat orders are the best testimonial of product performance and satisfied customers! That's why there are *more* Nolan Porta-Feeders in operation than any other make!

NOLAN PORTA-FEEDER

EXCLUSIVE FEATURES:

- Push-button operated
- Mounts on top of ties
- No excavation necessary
- No valves on track unit
- Cushioned anchorage
- Hydraulically protected from shock and overload
- Simplified hydraulic system
- Constant forward feeding motion
- Close-centered dogs
- Secured by rail clamps with shock-absorbing springs. No holes required in rails
- Shortest on the market—only 6 feet longer than mine car!
- The only COMPLETE line of car-spotting and car-loading equipment available!



NOTE: Nolan makes a special model for drop-bottom cars. Nolan also makes a HOLD-A-TRIP for down grades.

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George C. Hutchinson, Jr. 800 Koppers Building, Pittsburgh, Pa. Huntington Supply & Equipment Co. 423 First Huntington Nat'l Bank Bldg., Huntington, W. Va. E. C. Horne Machinery Co. 1726 Champa Street, Denver 2, Colorado. Frank C. Bennett, P.O. Box 154, Castle Gate, Utah. J. L. Thomas, 429 South 24th Street, Birmingham 5, Alabama. John North Associates, P.O. Box 185, Herbert, Mich. (Chicago District). Lovitt Safety Limited, Toronto 10, Canada

THE NOLAN COMPANY
106 Pennsylvania St., Beaverton, Ohio

Mines, Companies *(Continued)*

Charles, Va., coal fields, Blue Diamond Coal Co.'s Monarch mine, closed recently after 53 yr of operation.

Closure left only a number of small mines still operating in the field and put 100 men out of work. Forced out of business by mounting expenses, Monarch once employed as many as 600 miners but its work force gradually declined in recent years.

Labor

A new bituminous coal industry-union committee formed to enforce a boycott against non-union produced coal has elected Rep. Robert H. Mollohan (D-W. Va.) as its administrative officer.

Mr. Mollohan, who served two terms in the House is from Fairmont, W. Va. The committee was formed under the new industry-wide labor agreement to see that producers under contract to the United Mine Workers refuse to handle or process coal produced by non-union mine owners.

A District Court Award of $400,000 damages to Meadow Creek Coal Co., Putnam County, Tenn., against the United Mine Workers was upheld by the United States Court of Appeals.

The Court decided that there was adequate substantial evidence to support award of $300,000 compensatory damages for injuries to the firm's business as well as $100,000 punitive damages. The District Court's findings had shown that after the UMW lost an election to determine whether the miners wanted to join the union or not, it tried to close the mine by force.

Two coal companies were awarded a quarter-million dollar judgment in a U. S. District Court against the United Mine Workers and its District 19.

The award included $215,000 to the Osborn Mining Co., Whitley County, Ky., and $35,000 to the Love & Amos Coal Co., Nashville, Tenn. The judge said in his opinion the union had conducted what amounted to a "reign of terror" against the firms.

Utilization

A plan by Consolidated Edison aimed at partly reducing air pollution from coal has been turned down by the Federal Power Commission.

Con Ed proposed a switch from coal to natural gas in one of its New York City generating plants, suggesting that Transcontinental Gas Pipe Line Corp. carry the gas to the plant. The FPC reasoned that gas prices could be forced up if other utilities followed Con Ed's plan of buying gas directly from producers in the field.

Island Creek Coal Co. finished its new Coal Research Center at Holden, W. Va.

Raymond Salvati, company president, said he expects many benefits from the Center, especially in the metallurgical industry. "Coal carbonization," he stated, "will for the present receive priority at the Coal Research Center, which will have complete facilities for this project . . ."

Preparation Facilities

Crystal Block Coal & Co., Coke Co., Rawl, W. Va.—Contract closed with the Daniels Co., Contractors, Inc., for complete coal preparation plant, including a DMS dense-media precision washer and auxiliaries.

Walter H. Duncan, Inc., Shaw, W. Va.—Contract closed with the Irvin-Mc Kelvy Co. for complete tipple to handle 150 tph of coal. Includes crushers, picking tables, automatic slate ejector and sizing screens. Completion scheduled for April 1, 1959.

Buffalo Coal Co., Inc., Bayard, W. Va.—Contract closed with the Irvin-McKelvy Co. for complete facilities to load 200 tph of coal. Included are crushers, picking tables, sizing screens and automatic slate ejectors. Completion scheduled for May 1, 1959.

Bituminous Output

YEAR TO DATE	PRODUCTION
Feb. 14, 1959	51,512,000
Feb. 15, 1958	52,776,000

1959 output 2.4% behind 1958.
A month earlier output was 12.8% behind 1958.

WEEK ENDING	PRODUCTION
Feb. 14, 1959	8,245,000
Feb. 15, 1958	7,965,000

Anthracite Output

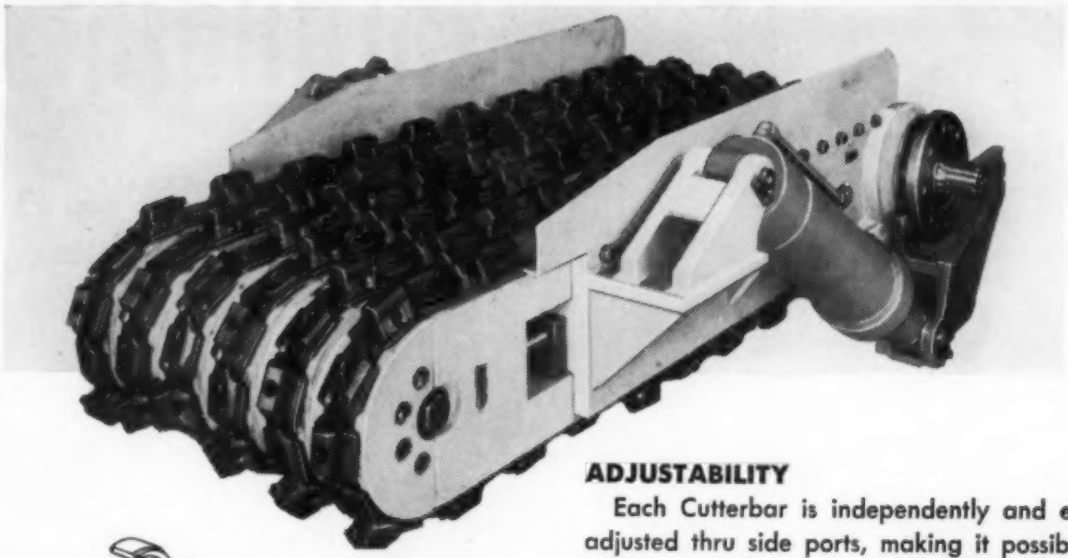
YEAR TO DATE	PRODUCTION
Feb. 14, 1959	2,936,000
Feb. 15, 1958	2,996,000

1959 output 2.0% behind 1958.
A month earlier output was 2.1% above 1958.

WEEK ENDING	PRODUCTION
Feb. 14, 1959	366,000
Feb. 15, 1958	379,000

another continuous mining advance . . . newest

Bowdil MULTI-BAR RIPPER HEAD

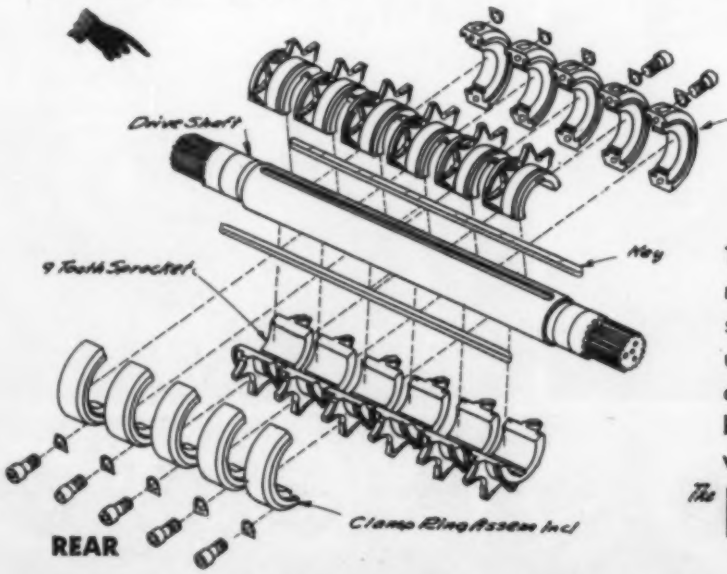


IMPROVED

special hard-surfaced Wearing Shoes used in heads of the Cutterbars eliminate maintenance on roller and bearings as formerly used.

REAR OF THE RIPPER HEAD FRAME

Sprockets are clamped to an oversize Shaft, locking Shaft and Sprockets into an integral unit equivalent in strength to a 9" diameter Shaft . . . completely eliminating deflection, the chief cause of bearing failure.



ADJUSTABILITY

Each Cutterbar is independently and easily adjusted thru side ports, making it possible to retain equal tension on all chains at all times.

INTERCHANGEABILITY

All chains are similar in kerf and lacing arrangement for interchangeability as desired. All sprockets are also interchangeable. Chains may be run with or without renewable liners in the Cutterbars to suit your conditions.

RIPPER HEAD ASSEMBLY

includes a special improved design Head Drive Shaft and Sprocket Assembly which makes it possible to renew a sprocket IN MINUTES without removing the Shaft . . . two-piece sprockets, held on the Double Keyed Shaft by special design Resilient Clamping Collars, maintain extreme tension to the Shaft.

► **DEPENDABILITY**

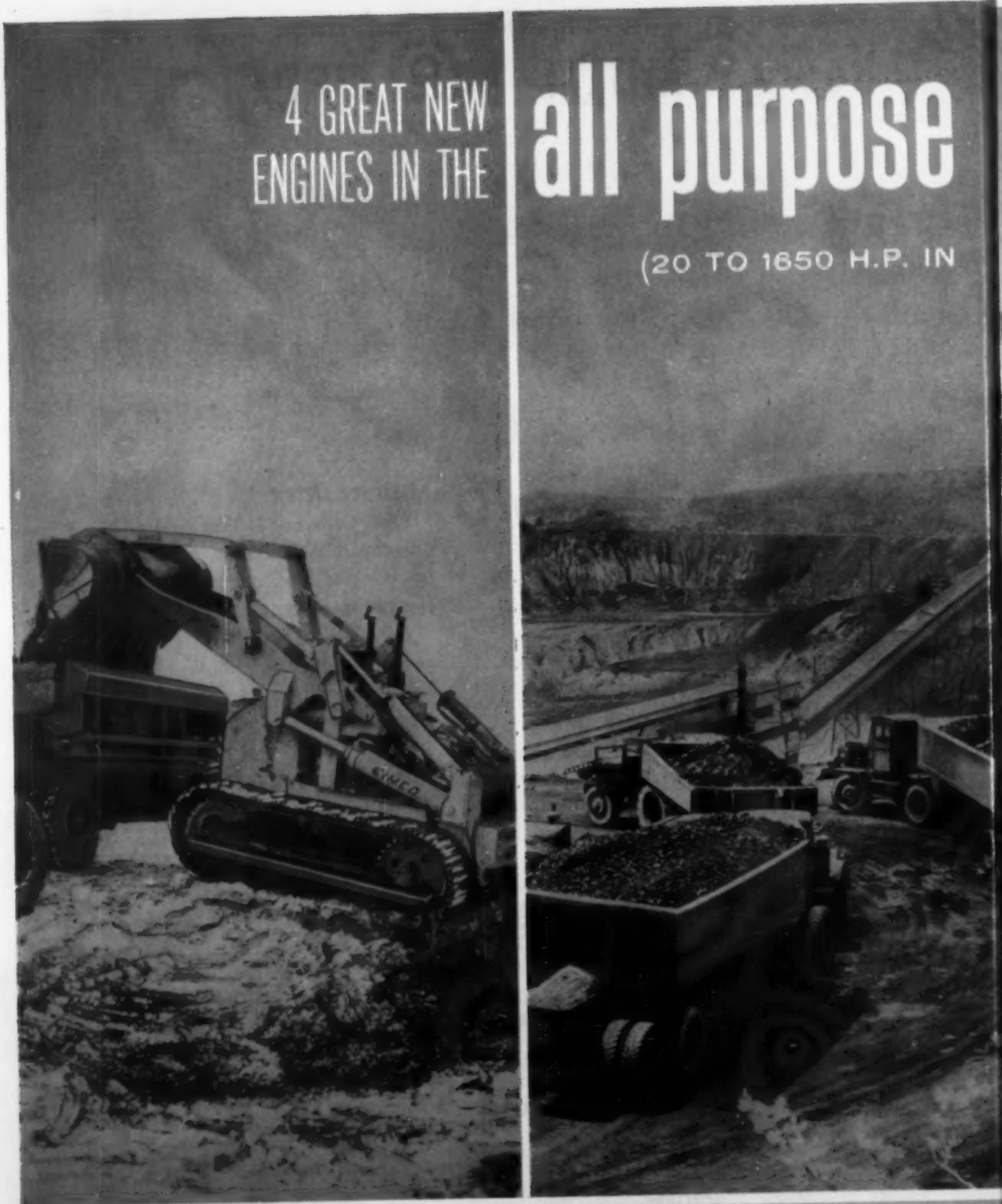
This design MULTI-BAR RIPPER HEAD is made from high grade alloy heat-treated steels. It has been, like all Bowdil products, thoroughly tested under severest conditions over a long period of time before announcement. This is in keeping with the standards of

The **BOWDIL COMPANY**
CANTON 1, OHIO

► *For illustrative information of this unit, write or call the factory: GLendale 6-7176*

4 GREAT NEW ENGINES IN THE all purpose

(20 TO 1650 H.P. IN



THE GM DIESEL ALL-PURPOSE POWER LINE 20 to 1650 H.P. in only 3 cylinder sizes

NEW "2-53" 20 to 47 H.P.

"2-71" 39 to 67 H.P.

NEW "3-53" 30 to 97 H.P.

"3-71" 51 to 118 H.P.

NEW "4-53" 51 to 130 H.P.

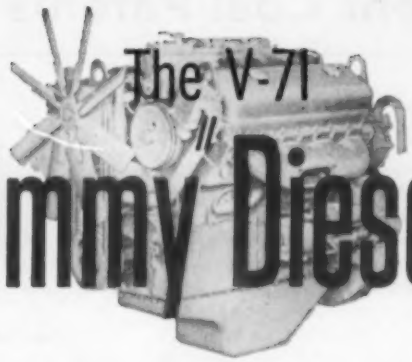
"4-71" 69 to 167 H.P.

NEW "6V-53" 76 to 195 H.P.

"6-71" 112 to 252 H.P.

power line

ONLY 3 CYLINDER SIZES)



The V-71 "Jimmy" Diesels

NEW FOR THE MINING INDUSTRY
6-, 8-, 12-, and 16-cylinder "V" versions of the famous GM Series 71 Diesel

The new V-71 "Jimmy" Diesels are a further illustration of GM Diesel's mighty new power concept—rounding out the All-Purpose Power Line—yet retaining the GM Diesel family relationship and parts interchangeability.

Here are engines that combine every profit-making, cost-saving advantage any Diesel has ever had. Diesels that boast an ingeniously engineered combination of new compactness, lightweight, high efficiency, durability and inexpensive maintenance.

These V-71 "Jimmy" Diesels are available in 6-, 8-, 12-, and 16-cylinder models rated from 112 to 675 h.p. plus 24- and 32-cylinder "Twins" up to 1650 h.p., when turbocharged. They're itching to get to work wherever there's hard work to be made easy.

To see how these new members of the All-Purpose Power Line meet your needs, write GM Diesel, Dept. M-3, Detroit 28, Michigan.

GM DIESEL

DETROIT DIESEL ENGINE DIVISION,
GENERAL MOTORS, DETROIT 28, MICH.

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario
Parts and Service Worldwide

NEW "6V-71" 112 to 252 H.P.
NEW "8V-71" 150 to 224 H.P.
"6-110" 160 to 335 H.P.
NEW "12V-71" 224 to 504 H.P.
NEW "16V-71" 300 to 675 H.P.
NEW "24V-71" (Twin 12) 448 to 1008 H.P.
NEW "32V-71" (Twin 16) 600 to 1350 H.P. (Turbocharged—1650 H.P.)

Current Coal Patents

By: Oliver S. North

Mining equipment having cutting rotors adaptable to varying conditions, W. B. Jamison and B. L. Derringe (assigned to Bituminous Coal Research, Inc., Washington, D. C.), Jan. 13, 1959. Important tramming advantages are obtained in this coal cutting machine by the employment of a cutting rotor which may be adjusted, during operation, to cut kerfs of various diameters. Means are provided for adjusting the spacing between rotor axes, e. g., from a minimum spacing in which the kerfs overlap to a maximum spacing in which the kerfs are spaced apart. An improved rotor transmission assures synchronization of the arms of adjacent rotors. No. 2,868,526.

Continuous mining machine, G. F. H. von Stroh and S. Bowman (assigned to Bituminous Coal Research, Inc., Washington, D. C.), Jan. 13, 1959. Design for an improved mining machine of the rotor type, wherewith coal may be efficiently wedged into an opening cut into the coal by this apparatus. The coal face is trepanned and broken away at its centers. The mechanism is particularly useful in low seams, say 28 to 38 inches, as it cuts only a small area of kerf and accomplishes breaking by means of a wedge. The machine is highly maneuverable and quickly retractable. No. 2,868,527.

Boring type mining machine having drum type cusp cutter, F. Cartlidge, J. Gonski (assigned to Goodman Mfg. Co., Chicago, Ill.), Jan. 13, 1959. Design for a low and compact boring type mining machine for working low seams of coal. A plurality of intersecting bores are drilled into the face using rotary drum cutters in place of the usual endless cutter chains. No. 2,868,528.

Pusher plate means for boring type mining machine, R. C. Lundquist (assigned to Goodman Mfg. Co., Chicago, Ill.), Jan. 13, 1959. Improved pusher plate device for deflecting boring type mining machine cuttings into the machine conveyor. The range of movement of the lower trimmer bar is increased by providing slots in the pusher plates, and by sealing these slots throughout the range of vertical adjustment of the lower trimmer bar with respect to the boring head supports. No. 2,868,529.

Adjustable continuous mining machine of the boring type, J. Gonski (assigned to Goodman Mfg. Co., Chicago, Ill.), Jan. 13, 1959. Simple and adjustable mounting for the boring heads of a continuous mining machine used in low seams. Adjustable jacks are arranged to support the heads and transmit the end thrust from the boring heads to the main frame of the machine. No. 2,868,530.

Adjustable cusp cutter for boring type continuous mining machine, J. Gonski (assigned to Goodman Mfg. Co., Chicago, Ill.), Jan. 13, 1959. Improved form of low-seam continuous mining machine having an adjustable support for boring heads used for cutting out cusps left between the boring cutters. No. 2,868,531.

Mining and loading machine having a screening plate, A. A. M. Valantin, Jan. 13, 1959. Improvements in an endless chain type coal cutting and loading machine comprise a screening plate attached above the cutting or conveying side to provide a channel wherein a scraper is arranged to pick up fines and other broken coal which has fallen into

(*Continued on p 54*)

BEST FOR LOW SEAMS
THE WILCOX CONTINUOUS MINER

Now in the fifth year of producing coal from Alabama to Nova Scotia and as far west as Oklahoma . . .

HAS BEEN PROVEN

- *By producing coal in seams ranging from 28 to 46 inches thick*
- *By producing coal under roof conditions where other mechanical equipment has failed*
- *By producing coal with lower maintenance cost per ton than any miner on the market*
- *By producing up to 60 tons per man per shift*
- *By its unparalleled safety record*
- *By repeated orders of 95% of our customers from 1 to 12 miners per customer*

THESE FACTS along with the low initial cost, the low 25½ inch overall height, and many other features of the Wilcox Continuous Miner have been responsible for opening many new seams throughout the country.

THE WILCOX CONTINUOUS MINER IS YOUR ANSWER FOR MORE TONS PER MAN AT LESS COST PER TON

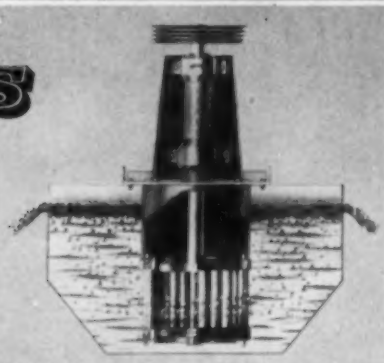
For additional information call CLifford 2-6555 Beckley, West Virginia, or write

WILCOX MANUFACTURING COMPANY

P. O. BOX 217 **RALEIGH, WEST VIRGINIA**

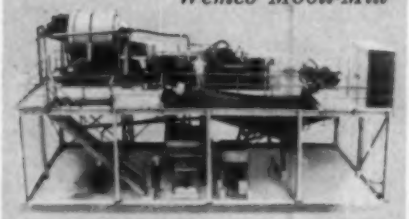
PRODUCERS

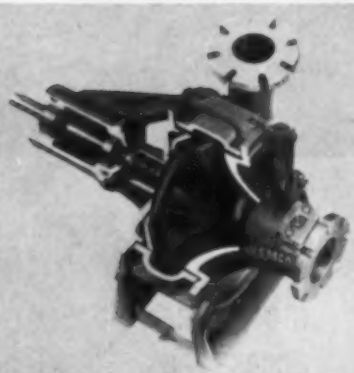
in the world of Coal



Wemco Fagergren Flotation Machine

Wemco Mobil-Mill





Wemco Torque-Flow Pump

. . . and other complete equipment
and services
for the Coal Industry

It's a combination geared to the progress of the coal industry: machines developed for more profitable high-grade production; skills paving the way for continuing improvements in application and results. Today — and in the future — depend on the men of Wemco to turn a problem into a profitable operation; look to Wemco equipment for top performance. Your questions will be answered promptly and positively — whatever the operation.

WEMCO®

Western Machinery Company
650 Fifth Street • San Francisco 7, Calif.

Thinking about bolting your roof? Remember that we offer more than proved bolts and accessories. Bethlehem contact men are available at all times to assist in installation and testing. Just call or write our nearest sales office. We'll do the rest.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

weatherproof... with Ashland **Permatreat** Coal Spray Oil!

1. **WEATHERPROOF.** Coal sprayed with Permatreat becomes weatherproof, dustproof, waterproof, windproof and non-corrosive. Resists freezing. Eliminates frozen car pockets.

2. **REFINERY-CONTROLLED QUALITY.** With Ashland Permatreat, you're assured of product uniformity. Permatreat is quality controlled and carefully refined to meet the needs of your operation.

3. **TECHNICAL AND RESEARCH SERVICE.** Helpful technical and research services are available to you from our nationally recognized specialists in oil treating of coal.

4. **CONVENIENT SUPPLY POINTS.** Large, dependable storage facilities located near the coal fields assure uninterrupted supplies of Permatreat for immediate delivery by tank car or transport truck.

ONE **Permatreat** MENT LASTS THE LIFE OF THE COAL!

For immediate service call any of these convenient Ashland Oil offices.

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Ashland PERMATREAT

ASHLAND OIL & REFINING COMPANY, Ashland, Kentucky

DORR-OLIVER *equipment for fine coal cleaning circuit at giant*

For sheer size and unique features of construction alone, U.S. Steel's preparation plant at Gary, W. Va., is one of the most interesting coal properties in operation today.

Dorr-Oliver equipment in the fine coal cleaning circuit plays an important role in the overall successful operation of this plant. Of primary significance is the Dorrco FluoSolids coal drying system. Other major Dorr-Oliver equipment units contributing to efficient operation include eight 44′ diameter bowl x 16′ wide rake Dorrco type HX Bowl Desiltors, two 120′ diameter type SS Thickeners and two heavy duty type W #8 Diaphragm Pumps. Essential features of plant operation are given in photo captions at right.

Now, perhaps your operation does not call for equipment of this magnitude. However, regardless of plant size, Dorr-Oliver equipment can point the way to more efficient, economical operation. For more information just drop a line to Dorr-Oliver Incorporated, Stamford, Connecticut.

OVERALL VIEW OF USS fine coal preparation plant at Gary, W. Va. Note the 120′ diameter Thickener tanks installed on roof. Plant is one of largest—if not the largest—of its type in the world.

DESILTOR FLOOR. Eight Dorrco Bowl Desiltors prepare table feed by desliming 750 tons per hour of ¼″ x 0 coal at approximately 100 mesh. Efficiency of desilting operation contributes to greater effectiveness of table plant.

DESILTOR RECIPROCATING RAKE ARMS convey oversize fraction from Desiltors up drainage deck to elevated point of discharge. Minimum fines permit high degree of dewatering of table concentrates, thereby reducing load on thermal drying plant.

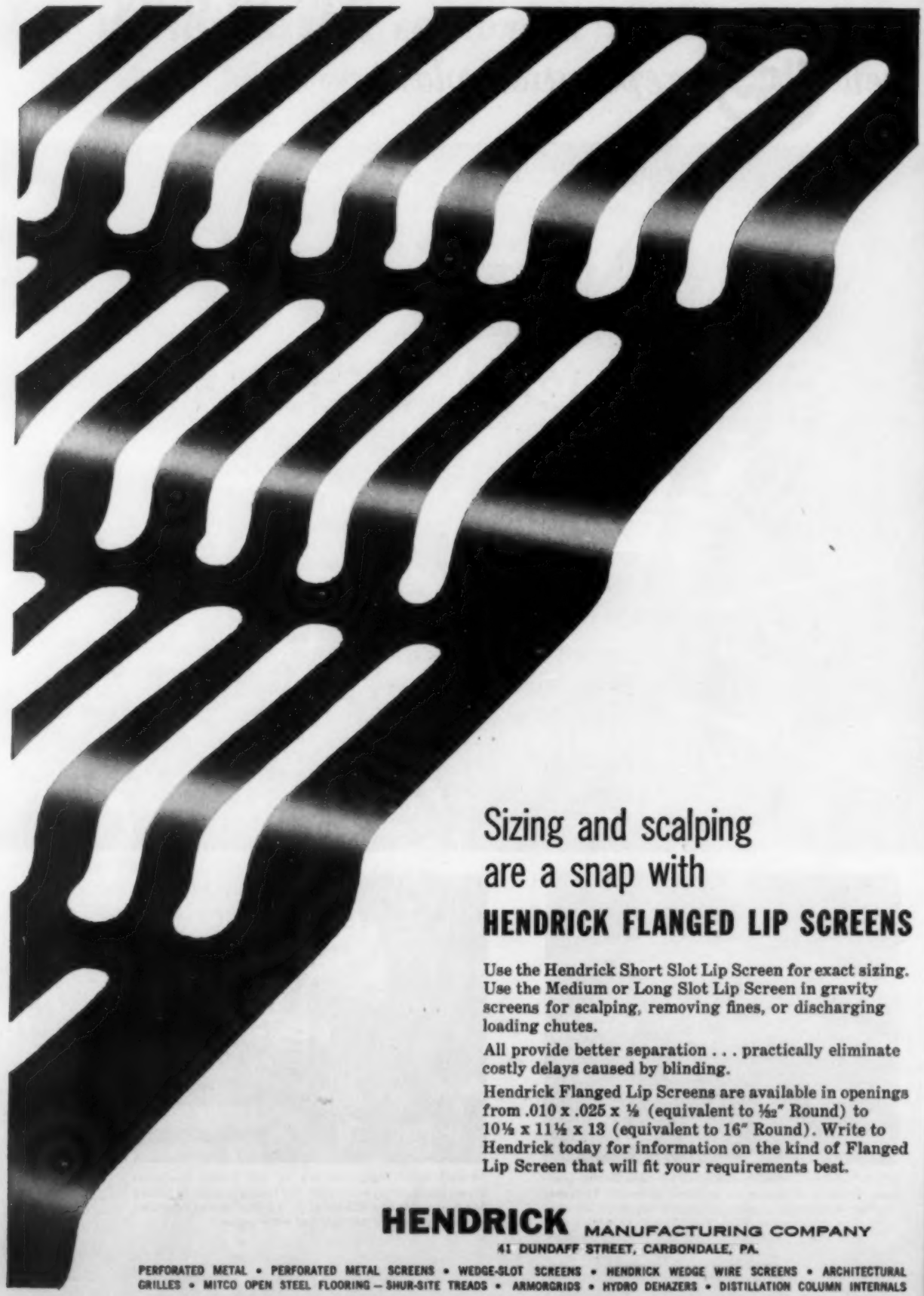
DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U. S. A.

Dorrco and FluoSolids – T.M. Reg. U.S. Pat. Off.

new USS *preparation plant*

ROOF-TOP THICKENERS handle minus 100-mesh Desiltor overflow, which is thickened by addition of starch. Thickener overflow is returned to plant as process water.

DRYING PLANT comprises two 14′ I.D. Dorrco FluoSolids Dryers plus auxiliary equipment. Plant was designed to remove 36 tph of water from 600 tph of ¼″ x 0 coal. Actual operation has nearly doubled this figure of water removal.



Sizing and scalping are a snap with

HENDRICK FLANGED LIP SCREENS

Use the Hendrick Short Slot Lip Screen for exact sizing. Use the Medium or Long Slot Lip Screen in gravity screens for scalping, removing fines, or discharging loading chutes.

All provide better separation . . . practically eliminate costly delays caused by blinding.

Hendrick Flanged Lip Screens are available in openings from .010 x .025 x ⅛ (equivalent to 1/32" Round) to 10⅛ x 11⅛ x 13 (equivalent to 16" Round). Write to Hendrick today for information on the kind of Flanged Lip Screen that will fit your requirements best.

HENDRICK MANUFACTURING COMPANY
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PERFORATED METAL • PERFORATED METAL SCREENS • WEDGE-SLOT SCREENS • HENDRICK WEDGE WIRE SCREENS • ARCHITECTURAL GRILLES • MITCO OPEN STEEL FLOORING — SHUR-SITE TREADS • ARMORGRIDS • HYDRO DEHAZERS • DISTILLATION COLUMN INTERNALS

The Wise Bird says . . .

"CLARKSON REDBIRD"

for the very finest in Conveyor Chain

Here's why...

Clarkson Redbird has the *welded* flight assembly that ends once and for all any need for adjustment, lessens wear and strain, eliminates stripped and corroded threads, loosened and lost nuts. *Clarkson Redbird* Conveyor Chain is shipped in assembled sections—no need to bolt flights to chain piece-by-piece . . . just join two or three sections to make a complete chain, ready for your hardest service. Ask us for the many supporting reasons for *Clarkson Redbird* leadership in conveyor chain performance—today!

National Mine Service Company

Koppers Building • Pittsburgh 19, Pa.

Distributing Divisions: ALL-STATE DIVISION Logan, W. Va. · ANTHRACITE DIVISION Forty Fort, Pa. · DEMECO DIVISION Beckley, W. Va. · KY.-VA. DIVISION Jenkins, Ky. · MOUNTAINEER DIVISION Morgantown, W. Va. · WESTERN KY. DIVISION Madisonville, Ky. · WHITEMAN DIVISION Indiana, Pa.

Manufacturing Divisions: ASHLAND DIVISION Ashland, Ky. · CLARKSON DIVISION Nashville, Ill. · GREENSBURG DIVISION Greensburg, Pa. · *In Canada* NATIONAL MINE SERVICE (CANADA) LIMITED Elliot Lake, Ontario

Patents (*Continued*)

the trench and transport the material to the conveyor. No. 2,868,532.

Conveyor belt idler, A. J. Kindig (assigned to The Jeffrey Mfg. Co., a corporation of Ohio), Jan. 20, 1959. Improved belt training troughing idler structure including means which is engaged by the conveyor belt when the latter moves out of central alignment in its run to adjust the idler for returning the belt into alignment. No. 2,869,712.

Scraper chain conveyor structures, A. W. Duncan (assigned to The Mining Engineering Co. Ltd., Worcester, England), Jan. 20, 1959. Scraper chain conveyor structure having upper and lower troughs retaining the ability to remove any trough in the conveyor run, but having closure means for the joint between upper troughs which forms a seal for the butt joint between adjacent troughs. No. 2,869,713.

Mine roof bolt with abutting shoulder preventing over-expansion, J. B. Dempsey (assigned to Pattin Mfg. Co., Inc., Marietta, Ohio), Jan. 27, 1959. Mine roof bolt assembly includes means for assuring that the wedge nut cannot be completely pulled through the anchoring shell and thereby cause the bolt and the wedge nut to fall out of the hole. This assembly is particularly useful for installation in relatively soft mine roof strata, where resistance to bolt turning does not build up rapidly on expansion of the shell. No. 2,870,666.

Centrifugal device for dehydrating a fine-granular material, W. G. J. Heckmann (assigned to Klockner-Humboldt-Deutz A.G., Koln, Germany), Jan. 27, 1959. This improved and simplified centrifugal device for dewatering coal slurries has driving members which are easily accessible. No. 2,870,913.

Screen, F. J. Fontein and H. H. Dreissen (assigned to Stamicarbon N.V., Heerlen, Netherlands), Feb. 3, 1959. Improved apparatus for separating mixtures of coal and waste of different particle sizes, wherein the mixture is fed to the concave side of a cylindrical curved screening deck in a substantially tangential direction. Energy requirements are lowered, yet relatively high capacity and separation sharpness are realized. No. 2,872,041.

Roof supports, A. W. Duncan (assigned to The Mining Engineering Co. Ltd., Worcester, England), Feb. 3, 1959. Means are provided for pre-loading mine roof chocks or props to a relatively high proportion of their final load capacity. The unit can be used in conjunction with standard types of props, and is independent of outside sources of power.

Continuous mining by cutting and crushing, W. Robbins and G. S. Jenkins (assigned to National Mine Service Co., Pittsburgh, Pa.), Feb. 3, 1959. This cutting head for use on a rotor shaft of a boring type mining machine is especially designed for mining in hard strata, such as coal containing hard impurities. The head imparts to the coal face both a cutting and an impact crushing action, and tends to produce larger lumps and a smaller amount of fines and dust than the ordinary boring head. No. 2,872,169.

Mining machine launching device, P. L. Alspaugh, J. H. Heimaster and R. L. McNeil (assigned to Union Carbide Corp., a corporation of N. Y.), Feb. 3, 1959. Design for a launching platform for positioning a boring type mining machine for starting a bore and to guide the machine and control its operation during starting and after the machine has passed into the bore. The platform can be raised or lowered to bring the machine to the desired elevation with respect to the seam face, where it is automatically leveled. No. 2,872,170.

the exclusive

FLEX-A-FOAM DUST MASK

(no other product like it . . . anywhere)

Here's everything that management and worker alike could possibly want in a dust respirator!

1. **Form-fitting design:** Self-adjusting to any size and shape of face without pressure or irritating discomfort.
2. **Attractive styling:** Smartly designed to suit the most discriminating wearer.
3. **Filtering efficiency:** Filters non-toxic dusts 100 times smaller than the eye can see.
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5. **Feather-like weight:** Weighs only 1 ounce complete.
6. **Simplicity and economy:** Only 4 tough, long-wearing inter-locking parts — all washable. Pure latex filter outwears throw-away type more than 100 to 1.

No wonder FLEX-A-FOAM is the one dust respirator workers welcome and WEAR!

Sample only $1.45 postpaid (industrial price only)

FLEX-A-FOAM® DUST MASK

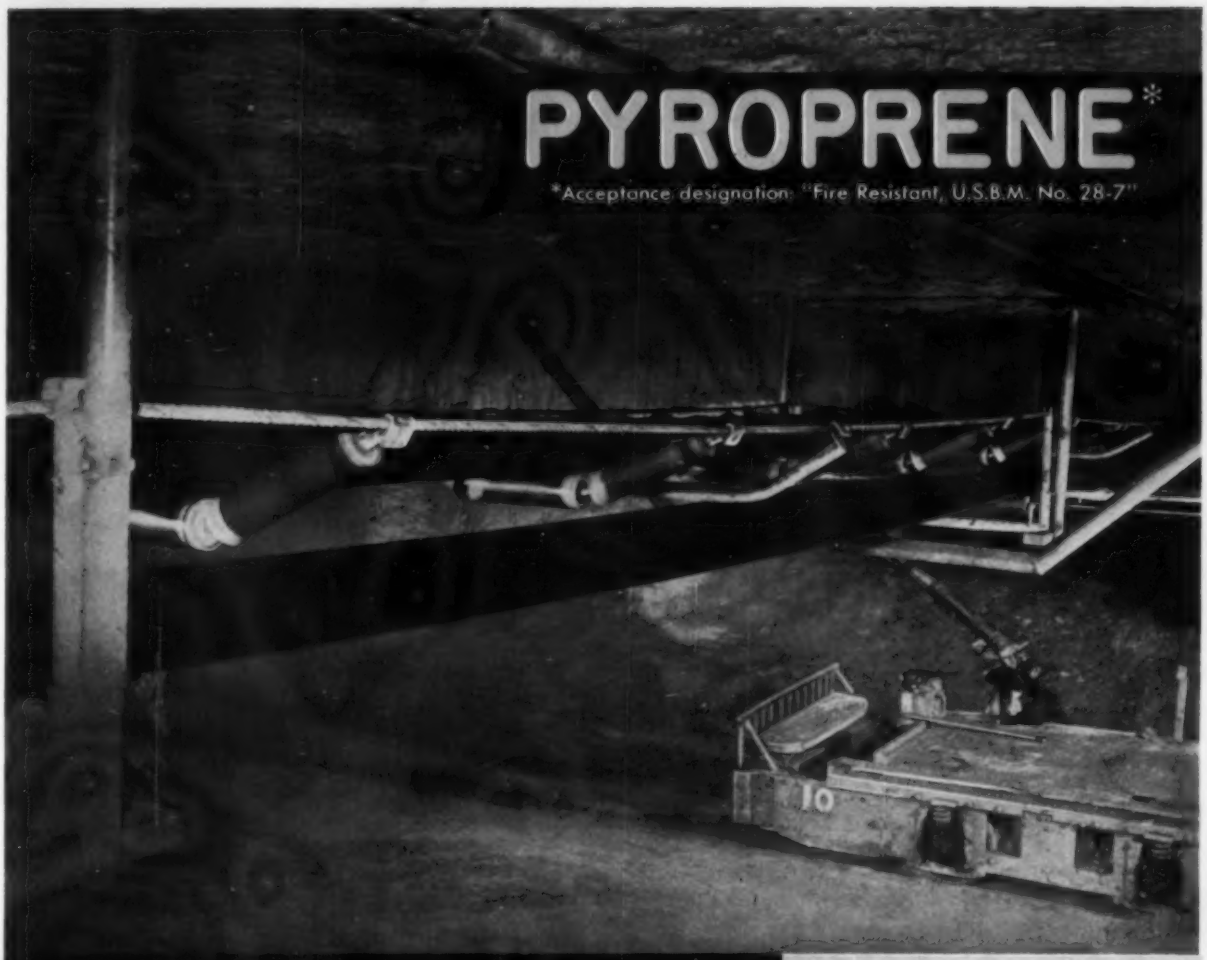
FLEXO Products, Inc. Westlake, Ohio

The Planning Stage

MEMBERS of National Coal Association meet to plan 1959 annual sessions to be held June 2-4 at the Shoreham Hotel, Washington. Seen are (left to right): Seated—R. E. Moore, Rich Hill Coal Mining Corp.; W. S. Webster, Walter Bledsoe & Co.; R. C. Luther, Pocahontas Fuel Co.; E. R. Phelps, Pittsburg & Midway Coal Mining Co.; and R. E. Sachs, Boone County Coal Corp. Standing—S. L. Jewell, Peabody Coal Co.; H. Scales, Pickands Mather & Co.; R. Chaney, NCA director of public relations; S. Colnon, Bell & Zoller Coal Co.; R. H. Hughes, Clinchfield Coal Co.; A. S. Kemper Jr., Eastern Coal Corp.; A. J. MacBride Jr., Consolidation Coal Co.; S. B. Johnson Jr., Lorado Coal Mining Co.; and J. J. Quinn, Rochester & Pittsburgh Coal Co.

PYROPRENE*

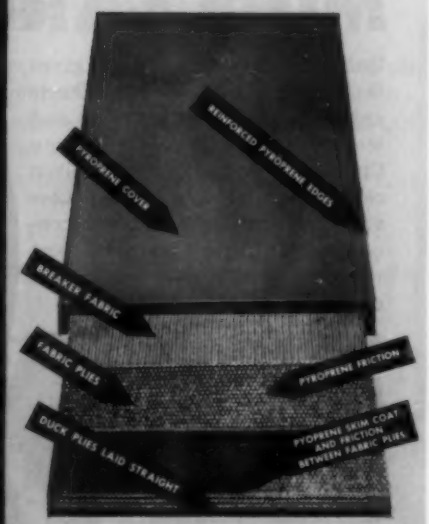
*Acceptance designation: "Fire Resistant, U.S.B.M. No. 28-7"



Here's one overhead that runs up big profits

This Acme-Hamilton 48-in. conveyor belt, on a Goodman Ropebelt Conveyor is carrying coal at 1500 tph with low maintenance costs and long service life. Note how nicely the belt troughs under the bulky load—and how flat it runs between the return idlers . . . sure signs of excellent construction and fine quality.

PYROPRENE PROTECTED against fire, Acme-Hamilton U.S.B.M. accepted belts will not feed or spread fire. The cover is fire-resistant Pyroprene; fabric plies and breaker fabric are encased with Pyroprene compound before the belt is built. Cover has exceptional resistance to abrasion and cutting. Write Acme-Hamilton Dept. CA-91.



Acme Hamilton

MANUFACTURING CORPORATION, TRENTON 3, N. J.

Divisions: Acme Rubber Mfg. Co. • Hamilton Rubber Mfg. Corp.

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The important figure is

14°

10 years operating experience proves Cyclones designed with 14° angle are more efficient classifiers and thickeners and thus are more economical. **Only the H & P Cyclones offer this advantage.** It makes good sense to specify the best —the money saving big performer— The H & P Cyclone.

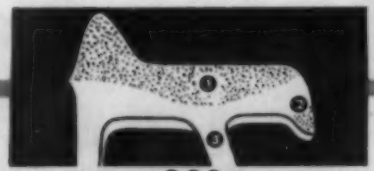
Write for Brochure No. 1157

Heyl & Patterson INC.

55 FORT PITT BLVD. · PITTSBURGH 22, PA.

acf Load-support MINE CAR WHEELS

Quick-chilling after casting gives acf Chilled Tread Car Wheels extra resistance to abrasion and wear, gives you real economy through long service life. Gray iron center costs less to mount, reduces vibration and effects of stress concentration. Curved plates support tread at load center: minimize damage to treads.



Cross Section of acf "Load Support" Mine Car Wheel showing: (1) uniform depth of hardening, (2) extra heavy overhang, (3) support at center of tread.

For further information, just ask your acf representative.

AMERICAN CAR AND FOUNDRY
DIVISION OF ACF INDUSTRIES, INCORPORATED
750 THIRD AVE., NEW YORK 17, N. Y.

Sales Offices: New York • Chicago • St. Louis • Cleveland • Washington • Philadelphia • San Francisco
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Equipment Approvals

Eleven approvals were issued during January.

Jeffrey Mfg. Co.—Type ML81C loading machine; five motors, four 15 hp and one 4 hp, 250 V, DC. Approval No. 2F-1427, Jan. 8.

Femco, Inc.—Model SF-2520 blasting unit for short-delay detonators, 20 shots or less. Approval No. 16D-9, Jan. 8.

J. H. Fletcher & Co.—Model DTA7 track-type roof control drill; one 15-hp motor, 230 V, DC. Approval No. 2F-1428, Jan. 12.

Ensign Electric & Mfg. Co.—Type GGJJ wheel-mounted distribution box; 220/440 V, AC. Approvals Nos. 2F-1429 and 2F-1429A, Jan. 15.

Herold Mfg. Co.—Type WA-SE-IV shearer-loader; one motor, 100 hp, 440 V, AC. Approval No. 2F-1430A, Jan. 16.

Eimco Corp.—Type 637-E roof-drilling machine; one motor, 25 hp, 250 V, DC. Approval No. 2F-1431, Jan. 16.

Joy Mfg. Co.—Type 14BU9-3AH loading machine; five motors, two 15 hp, two 7½ hp, and one 4 hp, 440 V, AC. Approval No. 2F-1432A, Jan. 19.

Joy Mfg. Co.—Type 8SC1PH/-PXH-1 cable reel shuttle car; four motors, two 20 hp, one 10 hp and one 5 hp, 440 V, AC. Approval No. 2F-1433A, Jan. 21.

Megator Pumps & Compressors—Type K3 mine pump; one motor, 7½ hp, 250 V, DC. Approval No. 2F-1434, Jan. 22.

Megator Pumps & Compressors—Type M50 mine pump; one motor, 15 hp, 230 V, DC. Approval No. 2F-1435, Jan. 27.

Ensign Electric & Mfg. Co.—Type L-K fabricated skid-mounted distribution box; 220/440 V, AC. Approvals Nos. 2F-1436 and 2F-1436A, Jan. 29

In the April Issue . . .

Don't miss the special 32-p preview of the American Mining Congress Coal Show to be held at Cleveland, May 10-14. You will want to take this issue with you as a time-saving guide to the exhibits and technical sessions.

Goodman continuous miner typifies the excellent cost-cutting machinery in use today. Simplified lubrication with quality Texaco lubricants helps keep equipment like this in profitable, uninterrupted operation for longer periods.

The more you mechanize, the more you need this simplified lubrication plan

Any breakdown of big, modern equipment, like the continuous miner shown above, seriously interrupts production schedules. That's why the more you mechanize, the more economical it is to adopt a Texaco Simplified Lubrication Plan. Often as few as 3 or 4 lubricants are all that's needed. That, in itself, just about ends failures caused by using the wrong lubricant.

Planned lubrication schedules in every Texaco Simplified Lubrication Plan also make good maintenance practice easy. And equipment produces more continuously because proper top grade lubricants prevent the causes of breakdown.

For example, consider Texaco Regal Oil R & O for hydraulic systems. In many cases, changing to Texaco Regal Oil R & O hydraulic fluid has resulted in a service life *8 times longer*. That's because this quality hydraulic fluid resists oxidation, sludging and foaming, and prevents wear and rust—the best guarantee you can get for long-lasting and uninterrupted operation.

Find out exactly how a few Texaco lubricants can keep *your* equipment running efficiently without breakdown. Call the nearest of more than 2,000 Texaco Distributing Plants in all States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

TUNE IN . . . Metropolitan Opera Radio Broadcasts Saturday Afternoons—CBS

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

FOR MAINTAINING HAUL AND ACCESS ROADS, the No. 14 pays off with high capacity and high availability. Its Turbocharged Cat Engine packs the power to utilize a 12-ft. or 14-ft. blade at highest practical working speeds!

CATERPILLAR'S PROJECT PAYDIRT

PAYS OFF FOR YOU AGAIN

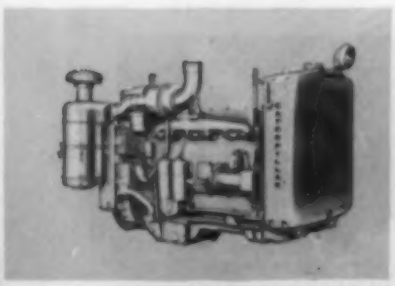
Big new Cat No. 14

MOST VERSATILE BIG GRADER EVER DEVELOPED

In the new No. 14 Series B, Caterpillar brings you the most versatile grader ever developed in the "big machine" field. Another major achievement in Caterpillar's "Project Paydirt," it answers your need for a unit that comes through dependably with higher, faster, lower-cost production on your tough road maintenance and construction jobs.

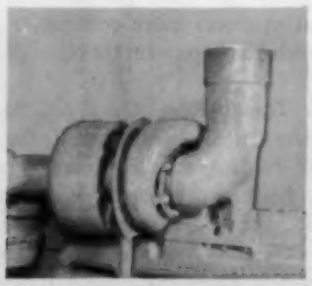
The first and only Turbocharged motor grader, the 150 HP No. 14 operates at the highest practical working speeds with either a 12-ft. or 14-ft. moldboard. It is built with extra strength to match its power and weight. It incorporates the latest engineering advances developed by Caterpillar research.

Example: New design permits increased clearance between moldboard and circle for greater loads. You'll also find exclusive time-tested Caterpillar developments. Example: The oil clutch. Some of these features are listed here, but there are many more. They all pay off in this one fact: You can use the No. 14 profitably anywhere.

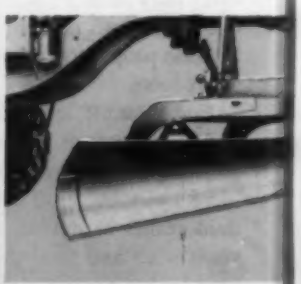


TURBOCHARGED CAT ENGINE: First and only Turbocharged engine in a grader. Its high torque rise of 18% pays off on your job.

NEW DRY-TYPE AIR CLEANER: Removes 99.8% of all dirt from intake air during every service hour. Can be serviced in 5 minutes.



NEW TURBOCHARGER: Close-up of Cat Turbocharger which greatly increases over-all engine performance. First such unit in any motor grader.



HIGH THROAT CLEARANCE: New desig permits increased clearance betwee moldboard and circle for unexcelle rolling action.

DITCHING AND SPREADING, the No. 14's low center of gravity and broad 8-ft. width pay off with extra blading and machine stability. An operator can work with confidence on uneven terrain—while maintaining high production.

4 Turbocharged Motor Grader

ED . . . WITH HIGH CAPACITY FOR EVERY APPLICATION!

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You'll
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They
o. 14

As a result, you don't have to pick "spots" to make the No. 14 a sound investment. This modern, all-purpose big grader will earn its keep on every application with high capacity and low operating cost. But see for yourself. Get the complete facts from your Caterpillar Dealer. Just say when and where—he'll demonstrate.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

✱***PROJECT PAYDIRT:*** Caterpillar's multi-million-dollar research and development program—to meet the continuing challenge of the greatest construction era in history with the highest production earthmoving machines ever developed.

EXCLUSIVE OIL CLUTCH: Provides up to 2,000 hours' service without adjustment, equal to about 12 months' "adjustment-free" operation.

PRECO AUTOMATIC BLADE CONTROL: Another Caterpillar exclusive, optional on the No. 14. Operator selects desired slope on dial. Now transistorized for freedom from maintenance and adjustment, the unit automatically maintains blade slope within ⅛ in. in 10 ft.

POWER STEERING AND POWER BRAKES: Provide fast, positive response and ease of operation that help operator maintain high production anywhere.

TUBELESS TIRES—14.00-24 (10-PLY RATING): All tires mounted on wide 10-in. rims to stiffen tire side-walls and reduce tire "roll." Large tires on front end improve machine stability.

UNEQUALED VISIBILITY: An operator, while seated, has an unobstructed view of critical areas at the front wheels, blade toe and circle.

NEW TURBOCHARGED NO. 14

Engine HP (rated at sea level)	150
Weight	29,280 lb.
Blade—standard	12 ft.
Optional	14 ft.
Tires—all around	14.00-24
Travel speeds—6 forward, 2 reverse	2.6 to 21.6 MPH
Turning radius	36 ft.

A COMPLETE MOTOR GRADER LINE!

With the addition of the No. 14, Caterpillar now offers a modern, heavy-duty motor grader for every purpose. Other units include the world-famous 115 HP, 23,000 lb. No. 12 and the 75 HP, 20,805 lb. No. 112. Like the No. 14, each is designed to do more work at lower cost with less down time than any unit in its class.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

DIESEL ENGINES · TRACTORS · MOTOR GRADERS
EARTHMOVING EQUIPMENT

BORN OF RESEARCH
PROVED IN THE FIELD

AC POWER DISTRIBUTION—D. E. Hamilton (left), General Electric Co.; V. H. Youel and A. C. Lordi, Westinghouse Electric Corp.; G. P. Benish, Joy Mfg. Co.; and T. R. Weichel, The Okonite Co.

AC MINING EQUIPMENT—J. A. Buss, Reliance Electric & Engineering Co.; J. B. Wren, Westinghouse Electric Co.; R. Holcombe, Jeffrey Mfg. Co.; E. Zucker and G. L. Tiley, Canadian Westinghouse, Ltd.; R. D. Greer, Joy Mfg. Co.; J. Pokelsek, Reliance Electric & Engineering Co.; A. E. Molinski, Bethlehem Mines Corp.; and A. L. Lee, Consolidation Coal Co.

Major theme of American Institute of Electrical Engineers special meeting:

Design and Application Of AC Mining Equipment

RECORD TURNOUT for the special technical conference of the American Institute of Electrical Engineers, Johnstown Sec., Fort Stanwix Hotel, Johnstown, Pa., Jan. 27, reflected growing coal-industry interest in the design and application of AC mining equipment. More than 170 delegates representing management and equipment manufacturers were in attendance.

Operational problems, designs and techniques of AC substations, portable switchhouse and power centers, underground cables, mining machines and hoist controls were discussed. A. C. Lordi, Westinghouse Electric Corp., was chairman of the afternoon session and J. A. Buss, Reliance Electric & Engineering Co., was chairman of the evening session. Others concerned with meeting and program arrangements were: F. R. Hugus, Joy Mfg. Co.; A. E. Molinski, Bethlehem Mines Corp.; R. M. Hunter, Rochester & Pittsburg Coal Co.; and W. R. Wood, Berwind-White Coal Mining Co.

Surface Substation and Portable Underground Switchhouses for AC Mines, D. E. Hamilton, General Electric Co., Schenectady, N. Y.

Performance reports on the operation of AC mines are evidence that mine operators are realizing the benefits expected from the use of AC-powered face machinery. Much of this success is directly a result of good overall power-system planning and the availability of surface substation equipment and underground switchhouses. However, it is important to recognize that coordination of all components in the system, including cable, cable couplers, mine load centers, background switchhouses, etc., is necessary in order to obtain the full benefit of this equipment.

Equipment discussed by Mr. Hamilton included the surface substation where service voltage is transformed down to the mine primary distribution voltage level, and the underground switchhouse. The major item that distinguishes the surface substation feeding power to an AC mine from an ordinary industrial-type substation is the manner of grounding the neutral of the primary distribution system to provide maximum safety to mine workers.

Voltage regulation is another major consideration in designing the power system for an AC mine. Steps that can be taken include buck or boost induction voltage regulators, and operating cables at or near their continuous current ratings.

The underground switchhouse is a portable high-voltage switching station installed to protect the branch feeder circuits in the mine. The basic protective relaying system comprises the following:

1. Phase overcurrent tripping using current transformers, either time and/or instantaneous overcurrent relays and the circuit-breaker shunt-trip coil.
2. Ground overcurrent tripping, usually accomplished by a window-type current transformer, instantaneous overcurrent relay, and the circuit breaker shunt trip coil.
3. Ground continuity relaying.

The Underground Mine Power Center for AC Mining, V. H. Youel, Westinghouse Electric Corp., Sharon, Pa.

Component arrangement of the mine power center is determined by space limitations, convenience of operation and access for maintenance. The main components include the primary cable entrance which provides an adequate cable termination, dry-type transformer and

low-voltage control section, including circuit breakers, relay panels, current transformers and outlet receptacles. Auxiliary components may include capacitor banks for load power-factor correction and auxiliary lighting and low voltage power supply transformers.

It is important that cables be properly terminated so that the termination is not the weak link in the cable system. Disconnect-type high-voltage cable couplings are usually specified to reduce the time and expense of frequent moves.

The transformer for the power supply at the mine face should be capable of delivering rated kva at the operating voltage with good voltage regulation. It should be suitable for location as near as possible to the center of the face loads. It should have minimum weight to be easily movable yet be of rugged construction to withstand the severe conditions characteristic of mining. Complete safety and reliability are essential requirements.

The low-voltage section of a mine power center performs functions of switching, phase-to-phase fault protection, ground-fault protection and sometimes limited overload cable protection. Disconnect-type feeder outlet receptacles with means to prevent uncoupling under load are included.

Underground Cable Choice and Installation for AC Mining, Thomas R. Weichel, The Okonite Co., Passaic, N. J.

Standardization of AC equipment within the past 3 or 4 yr plus development in mining systems has permitted standardization of many of the cables for both high- and low-voltage circuits. Certain basic mine-safety rules and regulations covering electrical cables and equipment must be followed to assure the safety of men and property. Federal and state regulations were based upon installations of DC systems. Until these regulations are modified to include modern AC systems and equipment, we must follow applicable sections of present mining laws and regulations or other electrical safety codes.

Power cables leading underground, whether they enter the mine through shaft, drift, slope or borehole, should be designed for the service intended, installed in a permanent manner and protected against damage from haulage equipment, falling materials, mine waters, electrolysis and any other destructive factors to which they may be subjected. This type of cable should be of multiconductor construction with all components encased in a metallic armor or such nonmetallic armor as a heavy neoprene sheath. All cables suspended in a shaft or borehole should be strong enough to support the weight of the cable without imposing severe strain upon the conductors and protective sheath or armor.

INDUSTRY MEETING
A Special COAL AGE Staff-Written Report

High-voltage distribution cables underground are commonly of nonmetallic neoprene-armored construction. Conductors are insulated with high-voltage ozone-resisting material. Each conductor is shielded with a tinned-copper shielding tape with grounding conductors in each interstice in contact with the shielding. The complete assembly is encased in neoprene.

Low-voltage portable cables between the transformer and the mining equipment require more frequent movement. Cables for secondary distribution circuits should be of a standard type of construction to permit easy replacement and make them interchangeable with other equipment. For portability, flexible stranding (Class G or H) cables should be used.

Trailing cables used with AC-powered mining equipment require three power conductors and one or more grounding conductors depending upon the type of construction. The three-conductor Type G round cable with three insulated power conductors and three grounding conductors is a standard construction and gives satisfactory service for most applications.

Safety Circuit Centers for AC Mining, G. P. Benish, Electrical Products Div., Joy Mfg. Co.

The safety circuit center is an essential part of the complete AC power distribution system. Specifications must be coordinated with those of the transformer substation which, in part, is also a distribution center. Low-voltage feeder-cable extensions must be carefully selected with respect to carrying capacity, voltage drop and handling. Distances of 1,000 ft and more are entirely feasible under favorable conditions, thus reducing transformer moves. Circuit breakers must be selected for proper type and rating for each application to afford maximum protection, and applied in conjunction with control circuitry and a ground-fault protective device.

AC-Powered Mining Machines, Robert C. Holcombe, Jeffrey Mfg. Co., and J. B. Wren, Westinghouse Electric Corp.

In building underground mining machines the electrical designer is faced with very special requirements. In addition to dust, moisture and corrosive atmospheres, he must plan to use the least possible space and at the same time get the best possible accessibility for operation, inspection and maintenance.

When converting a machine previously powered with DC motors, the designer must first consider the duty which each motor is to perform, what horse power is required on an RMS basis, what maximum torque is needed to slip tires or crawlers, at what voltage should the AC motors be expected to produce the required horse powers and torque, whether there is to be two motors operating in parallel with shafts mechanically connected, whether there must be speed control of a particular motor, whether each motor must fit exactly into a space which was formerly occupied by a DC motor, and whether standard NEMA frames can be used.

For controls he must consider whether he can use the same control station for AC as DC. Can he use line-starting, which has the lowest cost and is simplest from a maintenance standpoint? Is there something he can do to reduce starting currents? Can suitable starters be found which will not be too high for the available space? Is there a motor that must not run in the reverse direction as a result of incorrect connection to the power lines?

An AC Powered Shuttle Car, A. L. Lee, Consolidation Coal Co.

AC has for many years been a very satisfactory source of power for those types of mining equipment which require a modest overall torque range from an electrical motor, and where it is practical to use a power system which allows but a small voltage drop at the motor terminals. Typical three-phase AC motor characteristics of a beneficial nature compared to DC motors are:

1. Simplicity (mechanically and electrically).
2. Lower first cost.
3. Lower maintenance cost.
4. Simple and less costly control.
5. Simpler and more efficient power system.
6. Smaller size.
7. Less heating and smaller cables.

The characteristics detrimental to AC motor use in certain applications are:

1. They are deficient in overall torque range and require a high starting current in proportion to starting torque—this is, a higher and more variable ratio of amperes to torque when compared to a DC motor.
2. They will overheat very quickly under sustained overload. Special types of motors must be used for even moderate sustained overloads.

Multimotor AC-Powered Direct-Drive Shuttle Car, J. M. Pokelsek, Reliance Electric & Engineering Co., and R. D. Greer, Joy Mfg. Co.

Twenty-six multimotor AC shuttle cars are presently operating considerably cooler than the temperature for which their motors were adequately designed. General service records and further field

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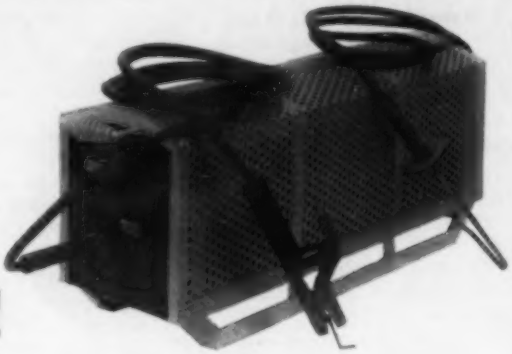

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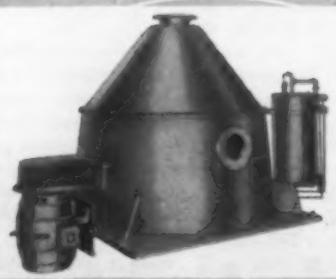

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tests confirm that the lower maintenance of the AC multimotor shuttle car is a proven fact. The downtime is low, and matching of loads to individual motors has proven very satisfactory. The motors have shared their loads as calculated and both the flexibility and efficiency have proven this to be the right approach to shuttle-car design. The mechanical construction allows room for even higher horsepower motors when required under adverse mining conditions.

Trends in Automatic Hoist Controls, G. L. Tiley and E. Zucker, Canadian Westinghouse Co., Ltd., Hamilton, Ont., Can.

Problems facing mine hoist engineers in the design and application of automatic hoist equipment were discussed by the authors, including duty-cycle requirements, types of hoists, the advantages of mine-hoist automation, available AC and DC control systems, overriding speed reference equipment and the features of modern automatic controls, and hoist brakes.

Meetings

American Mining Congress, Coal Div., Committee on Strip Mining, and Committee on Mechanical Mining, March 24 and 25, respectively—McCurdy Hotel, Evansville, Ind.

American Power Conference, 21st annual meeting, March 31 to April 2—Hotel Sherman, Chicago. Subjects include: direct conversion of heat to electricity; long-range goals for generation of electric power; thermonuclear fusion; and electric heating.

Indiana Coal Mining Institute, annual meeting, April 11—Hotel Deming, Terre Haute, Ind.

Open Pit Mining Association, June 18 — Missouri School of Mines & Metallurgy, Rolla, Mo.

Air Pollution Control Association, annual meeting, June 22-26—Hotel Statler, Los Angeles. Technical sessions and exhibits devoted to air pollution control.

Rocky Mountain Coal Mining Institute, June 28, to July 1—Antlers Hotel, Colorado Springs, Colo. Subjects include modern mining methods, new equipment, safety, etc.

International Briquetting Association, Briquetting Conference, August 24, 25 and 26—Glacier Park Lodge, Glacier Park, Mont.

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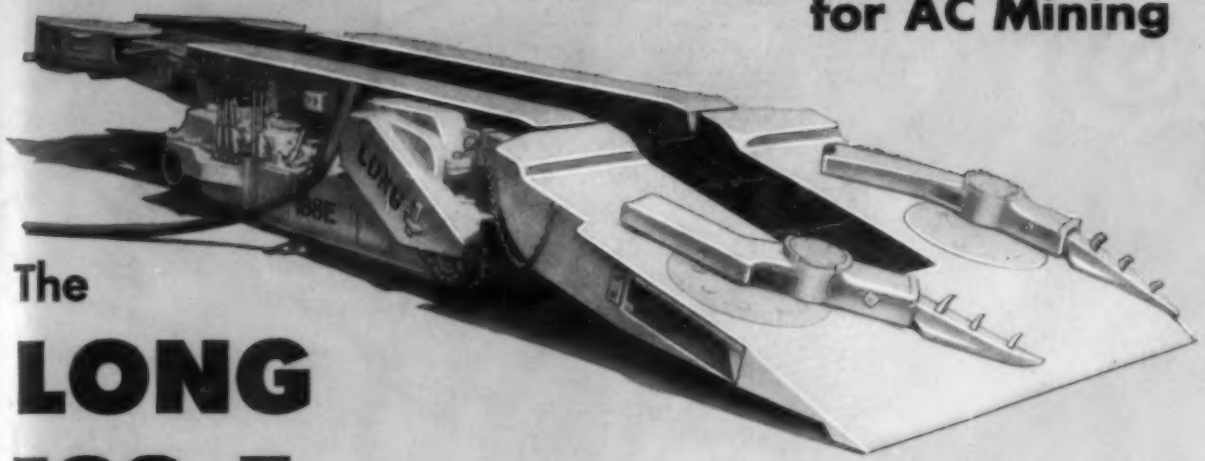
Low Height, high performance 80 HP loader for AC Mining



The LONG 188-E

Makes Maximum Use of AC design advantages

Unlike DC motors, AC types do not develop maximum torque when starting—also high inrush currents are characteristic with AC motors starting loaded. In the LONG 188-E, a single 80 HP motor powers the machine through clutches with full pull-out torque available. This single motor is started light and runs continuously during operation, with all machine functions controlled by a single bank of finger-tip control valves. The result—inrush and torque problems characteristic of multi-motored designs are eliminated. In addition to the 80 HP motor, one circuit breaker, one size 4 contactor, and one pushbutton complete the electrical circuit of this powerful loader.

Offers greater simplicity—top performance

Only LONG manufactures single motor gathering arm loaders with full independent crawler control. This highly successful feature permits the machine to turn in its own length and, combined with extra length crawlers, extra power and high speed gives the 188-E maximum maneuverability.

Provides high-capacity operation

The 188-E, with its greater power, stepped-up speed and clutch capacity, will maintain loading rates of 8-10 tons per minute in heavy going.

Costs less initially—less to maintain

With no more than half the moving parts of most multi-motored designs, the 188-E can be depended on for lowest possible maintenance costs, plus economies in spare parts inventory. Simpler design is reflected in important savings in first cost also.

The LONG 188-E is available in overall heights as low as 25¾". Machines specially designed for rock and other minerals also available.

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Devoted to the Operating, Technical and Business Problems of the Coal-Mining Industry

COAL AGE

MARCH, 1959

IVAN A. GIVEN, EDITOR

Outlook for Exports

WEST GERMANY'S recent decision to impose a tariff of $4.76 per ton on U. S. coal beyond the first 4,800,000 tons per year points up even more sharply the role of exports in the U. S. economy, and the possible uncertainties surrounding their future. In other words, will the U. S coal industry continue to enjoy the benefits flowing out of overseas shipments of 35 to 40 million tons per year?

Three things are involved—political considerations, the level of the economy of the importing country and the availability, assuming imports continue to be necessary, of alternate sources of supply. Political action—either arbitrary or dictated by compelling circumstances—is a risk that must always be run by exporters. However, political action usually must yield to economic necessities if the product is really needed.

What is the situation in West Germany—and in Europe—as to need and supply? Like the U. S., Europe also has been suffering a recession, and this curb on consumption has been accentuated by warm weather and a rise in oil use. But Europe expects to grow and continue to raise its standard of living, and therefore, like the U. S., will use more and more energy. And as in the U. S. there will be no substitute—for the time being at least—for coal, for steel and certain other specialty uses, and for general heavy industrial and manufacturing operations.

In the future, therefore, the pressure will be to raise the consumption of coal in Europe while the difficulty of meeting the increased demand from mines within the area will continue, as will the difficulty of meeting needs by relying on Communist-bloc countries. So, in spite of political eruptions and recessions, Europe will need more and more coal, and for that it cannot supply itself the U. S. will remain the logical if not the only source.

After Lewis, What?

MAN BEING MORTAL, the question that heads this discussion could become a very real one at any moment. In any event each passing day brings the time when the event must be confronted that much closer. Mr. Lewis being what he is the vacuum that will be left when he yields the reins will be even greater than that ordinarily resulting from a break in leadership. Perhaps this editorial could again be as premature as the full-dress discussion under the same heading in the June, 1953, issue of *Coal Age*, but the situation is exactly the same. As a result, the industry must be prepared for the possibility of a period of uncertainty, confusion and perhaps disruption of orderly operations unless strong leadership makes an early appearance after the event.

In the immediate future, producers have little to fear from direct reduction as long as they can deliver a high-quality, low-cost product. But, long-range, coal must swing with new trends in steelmaking. The potential plum: A market of 170 to 185 million tons of coal and coal equivalent by 1975.

DIRECT REDUCTION has immediate growth prospects for specialized, small-scale production. Typical is the 200 tpd Fierro Esponja plant, Monterrey, Mexico. Here,

Coal for Steel . . . The Future of

By **W. A. Raleigh Jr.**
Associate Editor, Coal Age

BY EVOLUTION not by revolution — that's the story in capsule of how steelmen currently feel about direct reduction and its prospects for replacing the conventional coke-oven blast-furnace method of converting iron ore to metallic iron.

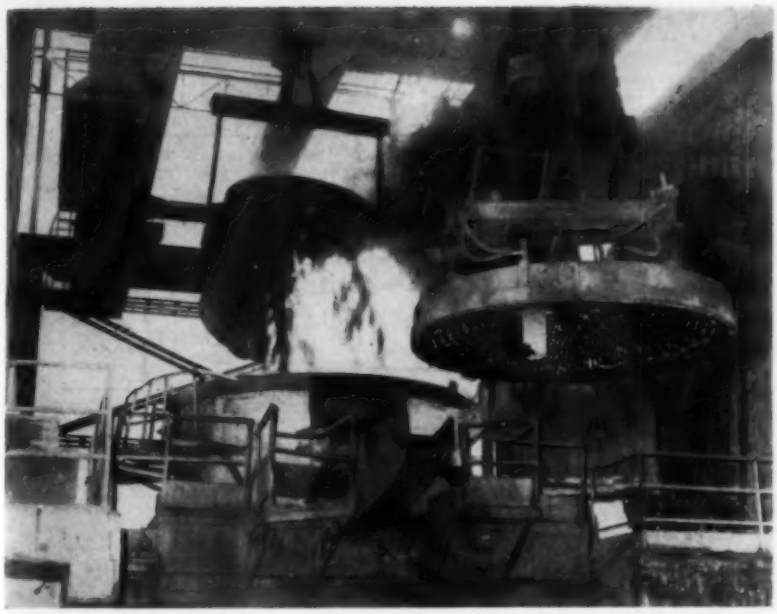
The statement is based on a *Coal Age* check with steel industry executives and analysts who are now making such comments as the following:

- Technical and economic developments suggest a slow change-over to the direct-reduction processes. Even this, however, is not a certainty. Thus, most companies are simultaneously (1) pursuing greater economies in conventional coke-oven blast-furnace techniques and (2) conducting continuing studies of direct reduction.
- Conventional methods are still favored because they generally offer better opportunities for reducing present output costs and a less costly means of meeting increases in demand during the immediate future.
- To a considerable extent, sintering has killed the flurry of excitement over direct-reduction processes during the past 5 yr. Direct reduction may come in for up to 10% of total steel output. Generally, however, the major emphasis is to improve the production efficiency of existing plants.
- Direct-reduction plants will materialize in geographic situations where small-scale local production is desired and coking coals are not available. Also, as the point of maximum economies is reached in conventional practices, new mass-tonnage plants will be designed to incorporate direct-reduction and other new technology.
- A substantial increase in the use of direct-reduction processes might occur with changes in the geographical pattern of the steel industry, if the changed pattern makes coal less accessible. By and large, though, coal producers have little to worry about as long as they can deliver a well-prepared product at low cost. Also, there is a future for coal as a carbonizing agent and hydrogen source of some direct-reduction processes.

Steelmen generally shy away from putting a precise timetable on the tempo of evolution to direct reduction. For one main reason the answers just aren't clear-cut. They realize, for example, that a major break-through or unpredictable obstacles in steel technology tomorrow could undermine any forecast today. But one authoritative industry voice, the magazine *Steel*, gives this perspective:

"The crystal ball shows a long-term evolution away from the blast furnace and open hearth. That steelmaking team will probably reach its peak during the next 10 yr (but another 50 yr may not see the last of it). The oxygen converter and electric furnace will continue to pick up more carbon-steel business. Direct reduction will become practical on a small scale and will grow slowly as competing methods fight for popularity, but it will be a long time before it seriously threatens any major blast-furnace plant."

Come what may, this much is quite clear—direct reduction and other technological trends in steelmaking cannot be wrapped up separately in neat little packages with red and green bows distinctly marking conventional and new practices. When and where economically at-



reformed natural gas reduces iron ore in a reactor (left). The sponge-iron product is then charged (above) to the electric furnace for making high-quality steels.

Direct Reduction

tractive and technically feasible, each technique has its place in the total scheme of things now and in the future. How and why steel is implementing this basic philosophy and what the implementation means to coal is highlighted in the following pages. A panel (p 68) features "Direct Reduction . . . Progress and Prospects."

Direct Reduction: Part of Total Planning

The place of direct reduction in the total scheme of steelmaking practice can be best understood by considering it a part of a complex industry planning which is striving to:

1. Accommodate the shift from direct-shipping to imported and low-grade iron ores.
2. Adjust to the pressure of rising labor costs.
3. Provide the means of increasing capacity at lowest possible cost.

The Shift in Iron-Ore Supply—An estimate made by the President's Material Policy Commission in 1952 pointed up the changing pattern of iron ore supply. Based on plans and expectations of producing companies, the estimate showed the following:

Potential Annual Supply U. S. Iron Ore

Major Ore-Producing Area	Millions of Long Tons 1950-55	1955-65	1965-75
Lake Superior high-grade ores....	80	65	50
Lake Superior low-grade taconites	5	15	20
Labrador-Quebec....	10	20	40
Venezuela.....	4	25	40

Thus, from historical dependence on Lake Superior high-grade iron ores the steel industry is shifting to primary dependence on imports and Lake Superior low-grade taconites. The shift has come as a necessary adjustment to dwindling supplies of Lake Superior high-grade product and to increasing future ore needs. The four producing areas listed, plus other unlisted U. S. and foreign sources, will provide a potential annual supply of 211 million tons by 1965-75—54% more than the 137 million tons of estimated supply from all sources during 1950-55.

Although the Central Area (Pittsburgh-Youngstown-Lake Erie-western New York-Detroit-Chicago) will remain the chief steel-producing region, PMPC's complete forecast also shows an accelerated trend toward decentralization. Between 1950-55 and 1965-75, consumption of iron ore in the Central Area is slated to increase only 22%; it should, however, more than double in the Eastern, Western and Gulf areas.

Pressure of Labor Costs—In today's highly competitive market, steelmen know they must gain maximum control of, or adjustment to, major cost elements if they are to hold old and develop new customers, realize a reasonable profit for management and stockholders, and plan for new additions, replacements or improvements in plant facilities.

Among other rising production costs, labor is most prominently reflected in a comparison of past and present steel prices. An arithmetical price composite of finished steel products shows a 103% increase in finished steel prices, from $72.33 to $147.08 per ton, between 1947 and 1958. During the same period, the industry's minimum hourly wage also jumped 103% from $0.965 to $1.96. And another round of wage boosts is a near-sure bet to follow from negotiation of a new labor contract this year.

Thus, holding the line on labor costs, as far as keeping the industry's basic wage rate down is concerned, has become virtually impossible. The United Steelworkers, in common with most of the Nation's other labor unions, has not yet bowed to the logic of restraint in the wage-price spiral; nor is it likely to in an economy bent on long-range boosts in production. The upshot: Control of the basic wage rate and fringe benefits, can only be partial—at best taking the form of effective resistance to unreasonable demands; at worst, the grim alternative of a strike and complete production shutdown.

Steel executives share with coal management increasing concern that wage hikes are outstripping gains in productivity. They recognize, however, that their best answer to rising labor costs is bearing down to accelerate productivity gains. This means more extensive mechanization, a speedup in automation, and a thorough pruning of inefficiencies in production methods and raw materials use.

High Cost of Expansion—Present capacity of the Nation's steel mills is 147 million tons. By 1975, industry

Direct Reduction... Progress and Prospects

THE CHANGE-OVER to direct reduction as the basis for making the Nation's pig iron—for reasons cited in the main text—will most likely be evolutionary, not revolutionary. This statement, however, should not obscure these facts: Direct reduction is backed by aggressive research and development effort and limited commercial use has already begun with immediate opportunities for growth.

Research and Development—In some measure, the volume of research can be judged by the fact that over 240 direct reduction processes were patented in the U. S. alone up to 1951. *Engineering and Mining Journal*, a McGraw-Hill publication, breaks all processes down into two main groups: those using gaseous reducing agents in a fluidized reaction, and those performed in shaft furnaces, kilns or retorts. Reports from E&MJ and other sources show that the most promising or most actively researched processes include the following: (For more detailed data, see E&MJ, December, 1957.)

1. The R.N process (above), National Lead Co. and Republic Steel Corp., uses a kiln which produces 85 to 95% reduced iron, rejecting some 90% of the sulphur and phosphorus. R-N capital costs are estimated to be 50% of a blast furnace-open hearth installation of equal capacity. In 1957, it was reported that over 50,000 tons of R-N Iron had been produced at a pilot plant in Alabama.

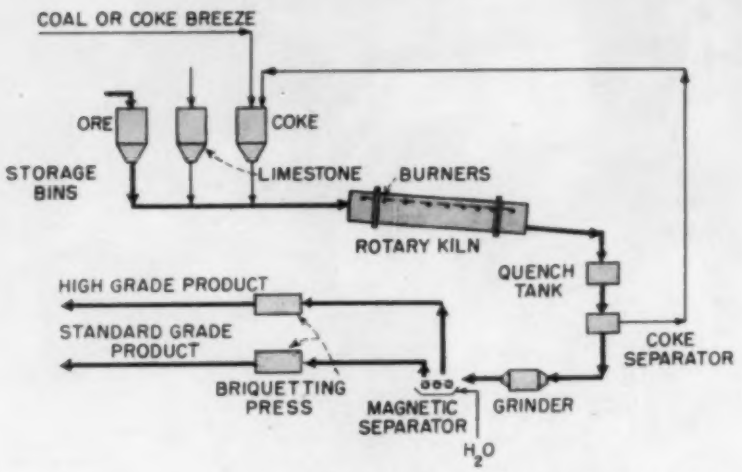
2. The H-Iron process (above-right), Hydrocarbon Research Inc. and Bethlehem Steel Co., uses natural gas or fuel oil to produce the hydrogen needed for reaction. Hydrocarbon Research has its own generating process, a patented partial oxidation of natural gas or fuel oil. But any hydrogen source can be used, including coal. H-Iron is a batch method.

3. The Esso-Little process, Esso-Research Inc. and Arthur D. Little Co., is a continuous gaseous-reduction method employing natural gas as the initial reducing agent. It differs from H-Iron in that some reduced iron must be present in the ore stream to crack the natural gas to form hydrogen and carbon monoxide, the final reducing agents.

4. The Madaras process, Madiron Corp., was first piloted during World War II at Longview, Texas. It is a batch process using steam to reform natural gas. Patents on the method have expired, opening up opportunities for wider use.

5. The U. S. Steel—Dorr Oliver process is another of the continuous gaseous-reduction type. Hydrogen is under lower pressure than in H-iron. A pilot plant is located at South Chicago, Ill.

R-N PROCESS (REPUBLIC STEEL-NATIONAL LEAD)



Redrawn from B. S. Old's Processes for Direct Reduction

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forecasts put minimum steel capacity needs at 200 million tons. In contemplating this magnitude of maximum demand, steel companies must face the fact that expanding annual ingot capacity now costs about $300 per ton, compared to $200 in 1947. In another 10 yr, costs could rise to $400 per ton. So, if expansion needs in 1975 were to be met solely by adding new conventional capacity the total expansion bill—assuming an average cost of $350 per ton—would come to $19 billion.

The prospect of financing that kind of expansion—especially in view of today's unfavorable depreciation laws—makes steelmen uneasy. Most admit raising that kind of money is the industry's biggest single problem.

Adding up steel's planning complex, no part can be completely separated from the other. The depleted supply of Lake Superior direct-shipping ores has forced the steel industry to develop techniques for upgrading or beneficiating low-grade ores. It has also compelled it to consider the advantages of setting up plants in areas that will permit reduced freight costs for importing iron ore as well as for shipping finished steel products to local markets.

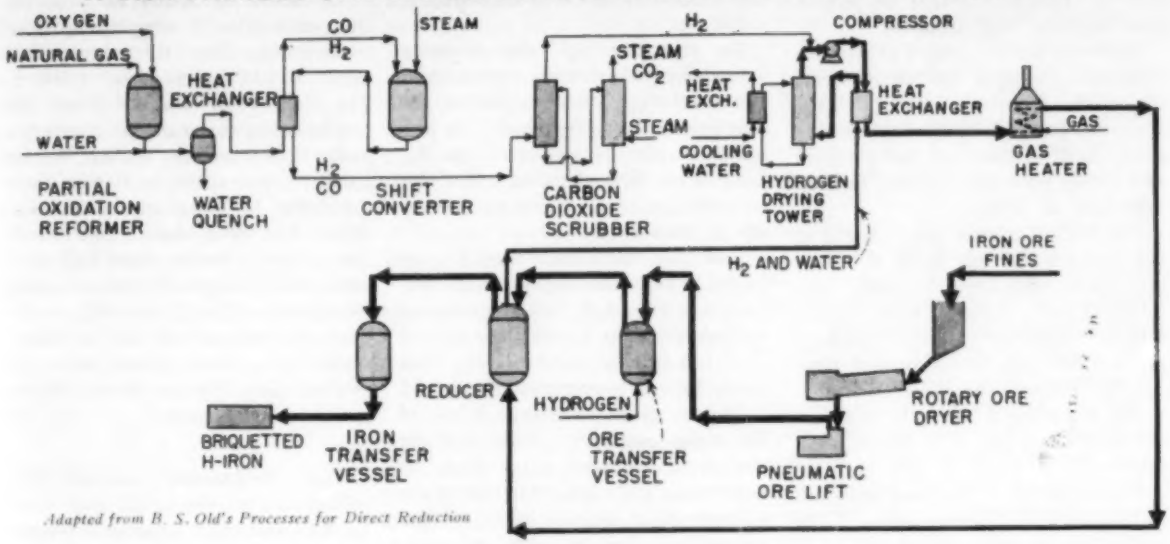
In turn, new and improved beneficiation techniques have opened tangible opportunities for more efficient blast-furnace operation. And the trend to decentralized production in coal-deficient areas has encouraged the development of direct reduction as a substitute for the blast-furnace, and of the electric furnace and oxygen converter as substitutes for open-hearth steelmaking.

Withal, the prospect of a nonending series of wage hikes and the high cost of expanding capacity have set hard limits on the amount of money available for conversion from conventional to revolutionary new steelmaking techniques. As a result, direct reduction, the electric furnace and the oxygen converter will move in gradually while the major expansion effort focuses on realizing maximum economies from existing integrated plants.

Boosting Blast Furnace Output

Better-prepared raw materials (iron ore, coke, limestone) and bet-

H-IRON PROCESS (HYDROCARBON RESEARCH, INC.-BETHLEHEM STEEL CO.)



Adapted from B. S. Old's Processes for Direct Reduction

6. The Strategic-Udy process, Strategic Materials Corp. and Koppers Co., Inc., uses a direct-fired rotary kiln for partial prereduction of iron ore before charging to the electric furnace. Major advantages reportedly include greatly reduced power needs in smelting, use of a wide range of ores and solid-fuel reductants, selective removal of tramp elements, and maximum control of pig-iron content.

7. The Cyclosteel process, currently under pilot-plant study in England, is a novel approach to the problem. Finely ground ore is fed with ground coal and air into a cyclone-inducing combustion chamber where the ore is reduced to molten iron and slag almost instantaneously. The process is at least 10 yr away from a commercial trial.

8. The Krupp-Penn process (Germany), via the kiln method, permits direct economic conversion of low-grade iron or high-silica ores to metallic iron. Almost any fine-grained solid fuel can be used—even inferior coals with high ash content. Southwest Engineering Co. says the process makes an excellent blast furnace feed with less cost than entailed in sintering iron ore fines. Plants have been built in Germany and the Far East.

9. The Domnarfvet Kiln process is used at Stora Kopparsberg Bergslags AB, Domnarfvet, Sweden, to magnetically roast hematite for further concentration by magnetic separation. Iron recovery is 95%.

10. The Norsk-Stall process (Norway) uses a shaft furnace and reformed methane to reduce the ore. This is considered a batch process.

11. The Wiberg-Soderfors process (Sweden) is of the gaseous-reduction type using a shaft furnace. It is reported to be one of the most successful operating processes to date. Energy demand per ton of pig iron produced is lower than any known process—only 9.2 million Btu, compared to 11 to 13 million Btu for a blast furnace, the next cheapest method.

12. The Sieurin or Höganas process (Sweden) uses a stationary kiln with coke, ore and limestone batches reacted together at 1,200 C for 3½ days, then cooled slowly to 150 C. Result is a sponge iron assaying 94%. One plant in operation has a capacity of 25,000 tons a year; another is under construction.

13. The HyL sponge-iron process, Hojalata y Lamina S. A. Monterrey, Mexico, and M. W. Kellogg, Inc., New York, yields a sponge iron (86% metallic) which may be substituted for pig iron or scrap in steel making. In the Fierro Esponja Plant (200 tpd), Monterrey, Durango, hematite ore is reduced directly in fixed-bed batch-type reactors with a reducing gas formed from natural gas. M. W. Kellogg has been awarded a contract to build a second plant (500 tpd) for Fierro Esponja.

Use Today and Tomorrow—As might be gathered from the preceding, overseas countries, notably Germany, Sweden, Norway and Mexico, have taken much of the lead in commercial application of direct-reduction processes. In the U. S., however, commercial momentum is building up.

Due to start operation this year, for example, is the first commercial application of the H-Iron process—a 50 tpd plant built by Alan Wood Steel Co. at Conshohocken, Pa. The plant will produce metallurgy-grade iron with excess capacity probably going into high-quality melting stock for open-hearth or electric-furnace feed.

Also in the picture, a major steel producer has reportedly asked for equipment bids to build a 500,000 tons-per-yr direct-reduction plant based on the R-N process. Observers say the location may be Alabama.

Numerous studies and plans are underway furthermore, to extend commercial use on a limited scale and for specialized purposes. High on the agenda are the prospects of (1) adding direct-reduction to integrated open-hearth and electric furnace plants as a substitute for purchased No. 1 scrap or high-grade lump ores; (2) setting up direct-reduction plants in local areas where small-scale production and the lack of coking coals makes them economically attractive.

Although direct reduction is off to a slow commercial start, few discount its long-range potentials for upsetting conventional practice in iron- and steel-making. Worth noting: Battelle Memorial Institute, Columbus, announced this year that 20 electric-utility, steel and furnace-equipment companies have signed up in a major project to assess the status and potentials of combining direct reduction and electric-furnace smelting in producing the Nation's steel.

ter control of their reduction are the keys to future increases in output from existing blast furnaces.

Speaking last November at the San Francisco Regional Technical Meeting of the American Iron and Steel Institute, John D. Saussaman, Kaiser Steel Corp., summed up past progress and future potentials in blast-furnace operation as follows:

"In 1947 a furnace producing 2 to 2.5 tons per day per sq ft of hearth area was considered a good producer. Thus a furnace with a 28-ft hearth diameter would produce about 1,500 tpd. At the present time in this country, there are 28-ft furnaces averaging 2,200 tpd, or a factor of 3.5 tons per sq ft hearth area. Similarly, in 1947 a coke rate of 1,700 lb per ton of iron was accepted as satisfactory, whereas today, 1,300 is the aim for most furnaces . . .

"As shown below, during the past 10 yr we have obtained the necessary tools to increase blast furnace production by 45% with only a 12% increase in coke or coal consumption:

Change in Furnace Efficiency

	1947	1958	% Increase
Tons hot metal per day (28-ft furnace)	1,500	2,200	45
Coke rate—lb per ton of iron	1,700	1,300	23.5
Tons of coke per day	1,275	1,430	12

"This in itself is quite an accomplishment. However, to most blast furnace operators it is only an indication of what can be done by research and aggressive management, and does not represent the ultimate in efficient production of iron. In fact, based on results obtained in the last 10 yr, it has been predicted that in the future the present 28-ft furnace will produce over 3,000 tpd, with a coke rate of 1,000 lb per ton of iron. [This productivity will be reached] by using operating practices already developed and by increasing the inside diameter of the furnace by installing thinner linings and better cooling."

Spotlight on Sintering—Among ore-beneficiating techniques, sintering is the glamor king of the day. Here's why:

An increasing amount of ore that U. S. steelmakers receive these days is made up of "fines." In a blast furnace these powdery particles tend to pack, creating a dense, impermeable layer that retards the de-oxidation process by blocking the reducing gases.

By screening out and sintering fines—baking them with a mixture of fine coke—large pieces of rather porous material can be made. In the blast furnace the converted ore facilitates the flow of gases, cuts down on coke use, and minimizes loss of ore as stack fines.

Last year, the Armco Steel Co. installed a new sintering plant at Ashland, Ky. *Iron Age*, took the occasion to underscore its significance as part of a fast-moving trend to raise iron production at lowest possible cost:

"Armco's new installation is one of 26 major sintering plants recently completed or coming up soon. Its 2,400-ton daily capacity is part of the industry-wide addition of 20 million annual tons for this year and next. Coming on top of the 13 million tons added in the 4 yr ending December, 1957, the current boost will give U. S. mills total sintering capacity of 64 million tons a year. That will be enough to put the Nation's blast furnaces on a diet of 50% sinter at full capacity. Along with coarse ore and taconite pellets, it will be enough to give most furnaces fully beneficiated charges.

"The net result, say blast-furnace men, will be to hike ironmaking potential by a cool 20%. And this figure may head up toward 30% as mills go in more for sintering. This gain will cost the steel industry something like $300 million, possibly more. But the same tonnage gain from new blast furnaces would cost about twice as much."

Other Techniques—The drive on sintering has given new impetus to other techniques for upping blast-furnace productivity. Notable among these are self-fluxing sinter and "hotter air," or higher blast temperatures.

By pretreating with limestone fines (1/8 in or less), sintered ore can be made self-fluxing with the result that little or no chunk limestone (2 to 5 in) is needed in the furnace and coke needs are reduced. "Every major steel producer with blast furnaces to feed is either using some self-fluxing sinter or is considering the move," *Steel* reports. On top of the 20% output gain expected from sintering programs alone, industry analysts look for self-fluxing sinter to open the way for adding another 20%.

The move to "hotter air" involves the possibilities of stepping up blast temperatures from the conventional range of 1,000 F to about 1,400 F. The idea is not new but heavy dependence on direct-shipping ores has made it impractical. "Pushed beyond 1,000 F," one authority states, "these ores tend to 'hang' in the furnace, rather than move steadily and evenly down. Hotter temperatures will push more iron through the furnace, thus increasing output. They will also reduce the amount of coke required, since hotter blasts mean more by-product gas which can be recycled as fuel into the furnace."

Coal Preparation Critical—Since coal is one of the major cost items in raw materials expense, steelmen are aggressively exploring opportunities for its more efficient use. One executive explains: "The washing and blending of coals to produce a coke of proper chemical and physical properties is extremely important. In fact, it should be the first point of attack in any campaign to improve furnace production and efficiency."

As producers of most of their own coal needs, steel companies have long recognized the key role of coal preparation in the ironmaking process. They are also quick to credit commercial suppliers with their share of progress in improving the coal-washing art. Perhaps typical is this comment: "Unacceptable or barely acceptable coals are uncommon today—about 95% of the product is high standard."

In spite of progress so far, steelmen realize that optimum efficiency in coal preparation is an elusive goal. Its attainment is ever subject to changing impurity-removal, blending and sizing problems created by new sources of supply. It also is ever subject to technologic trends, such as direct reduction, which widen the range of coals usable in ironmaking.

Evidence of steel's continuing effort to upgrade coal usage comes, for example, in two U. S. Steel projects. A new coal cleaning plant—completed March, 1958, at Wellington, Utah—will serve blast-furnaces of the Columbia-Geneva Steel Div. Its function is to increase the strength and yield of coke made from blending various western high-volatile, medium-volatile and low-volatile coals

(*Coal Age*, February, 1959, p 120).

In another project at its Clairton (Pa.) Works, the Corporation is building a modern pilot plant devoted exclusively to coal preparation, coke, and coal-chemical research. It is scheduled for completion this year. Coal preparation studies will include any combination of operations such as crushing, pulverization, drying, bulk-density control, mixing and blending of coals, as well as possible admixtures of a variety of inert materials with coal. Possible areas of exploration will be the effect of various coal-preparation steps on coke strength, coking time, furnace coke-yield and coal-chemical yields.

Meaning to Coal

Evaluating the impact of new and changing steel technology during the next 15 yr is no easy task. But a careful blending of known and unknown factors—plus a general dash of crystal ball-gazing—indicates the net gain to coal could be considerable, providing the industry swings with current trends.

Market Appraisal—No matter which way you add up steel technology today, you come up with a steadily declining coke rate. This is an integral and basic part of the industry's drive to cut current and future costs. The most efficient blast furnaces are already operating at 1,300 lb of coke per ton of pig iron and a 1,000 lb rate is held within reach. The industry average fell from 1,947 lb in 1948 to 1,703 lb in 1957.

Several factors, however, rule out cause for alarm as far as steel's volume use of coal is concerned. For one thing, future dips in the coke rate should at least be partially offset by long-range increases in total pig-iron demand. In spite of the fact, for example, that the coke rate fell between 1947 and 1957 as noted above, total coke production moved up from 73.4 to 76 million tons.

Similarly, coke capacity has shown a modest upward movement. In the face of a declining coke rate, oven-modernization and expansion programs took coke-oven capacity up from 73.7 to 80.3 million tons between 1949 and 1957.

"Because of consistently higher use of hot metal in open-hearth steelmaking," an informed observer also notes, "the peaks and valleys in demand for coking coal should level off." The trend to more use of hot metal is part of a steel industry effort to lessen dependence on purchased scrap. Uncontrollable fluctuations in price, supply and quality have made the commodity a continuing headache. *Business Week*, a McGraw-Hill publication, reports that "iron and steel scrap—long a feast-or-famine business—is becoming a victim of technological obsolescence."

Balancing out plus-and-minus factors in the use of coal as coke, Charles L. Potter, raw materials chief, Jones & Laughlin Steel Co., told the NCA convention last June:

"Even though less coke is consumed per ton of iron, the total tonnage throughout in an existing blast furnace will be increased. This is one of the most logical methods for the steel industry to develop the anticipated increased capacity. The lower coke per ton of iron also places coal in a more economical and more competitive position in relation to some of the new direct-reduction processes."

Along with a healthy outlook for use of coal as coke, other uses of coal stand to benefit from current trends in iron- and steel-making.

For example, in 1957, the steel industry used some 16 million tons of coal to produce electric power. Usage is expected to move up to 25 million tons by 1965 and to 35 million tons by 1975. Scaling up electricity needs will include increasing requirements for (1) sintering, pelletizing and other ore-benefication programs, (2) steelmaking via the electric furnace and oxygen converter, and (3) stepped-up mechanization and automation in rolling and finishing mills.

For direct use in upgrading low-grade ores, over 1.5 million tons of coke breeze and anthracite fines were used in 1957. If, as predicted by some, low-grade ores make up 40% of the total ore supply in 1980 (compared to an estimated 15% in 1960), higher-volume usage of these products is a pretty safe bet.

Coal also has opportunities for use in direct-reduction processes as pointed out by Dr. H. S. Turner, research and development head, Jones & Laughlin Steel Co.:

"There are two general approaches to direct reduction, one of which employs a coke breeze or char material based on coal; and it would appear that coal to be used in such processes would definitely have a broader range of physical and chemical characteristics than now correspond to specifications for metallurgical coke.

"The other broad category of direct reduction is through use of hydrogen or carbon monoxide and hydrogen which can generally be most economically generated from natural gas rather than from coal."

In sum total, the steel industry could be using 170 to 185 million tons of coal and coal equivalent by 1975. The estimate is based on trends noted previously, assumes a minimum steel demand of 200 million tons, and allows for a production of 20% of this total by new iron- and steel-making methods—including direct reduction and the electric furnace—which bypass the conventional iron- and steel-making route.

Action Needed—Tonnage predicted, of course, will not automatically fall in coal's lap. Critical to fulfillment is continuing sales and technical research on the changing coal and carbonizing needs of the steel industry (*Coal Age*, May, 1956, p 55). In more detail, coal should:

1. Bend every effort to prepare coking coals that offer maximum quality and economy in blast-furnace use.

2. Seek to widen the range of coals usable in coke-making. Among other factors, depletion of the highest coking grades has brought the need into focus. Currently the adjustment is blending low-, medium- and high-volatile coals and improving physical properties of the prepared product through better washing, grinding, sizing, etc. Long-range, researchers point to the possibilities of blending char with coking coal.

3. Investigate the prospects of converting steam-raising coals into briquettes or other form suitable for direct use in the blast furnace. One bituminous producer says such a product is technically feasible now.

4. Step up research on coal use in direct-reduction processes—not only in those processes now based on coal but also in those based on hydrogen. Producing hydrogen from coal is an old process although presently more costly than processes based on natural gas.

5. Explore new opportunities for steel's use of coal in making electric power and in processing ores.

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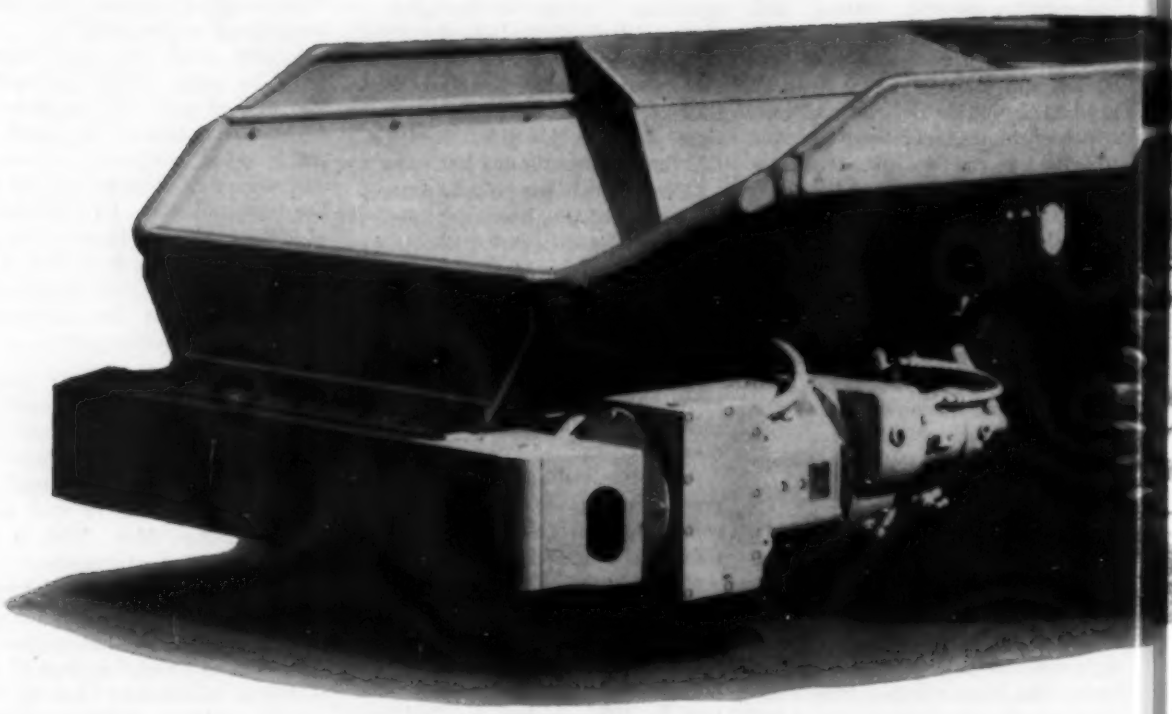

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MAJOR INCREASE IN TONS PER SHIFT follows introduction of boring-type miners for pillar removal at Mine No. 41. Water jets (left) help control dust. View at the right shows lift holed through to previously mined and caved area.

Bethlehem Mines Corporation
Marion Division

Mine No. 41
Barrackville, W. Va.

#1 Miner Performance

Date	Type	Location	Tons Mined	Shifts	Tons per Shift	Belt In Use	Type Pillar Line
Jan.–Feb. 1956.....	Solid	#9 Right #3 South	20,671	55	**375.8**	No	—
March–Sept. 1956....	Pillar	#9 Right #3 South	83,981	194	**432.9**	No	45°
Oct. 1956–Jan. 1957..	Solid	#8½ Right #3 South	56,640	135	**419.5**	No	—
Feb.–Aug. 1957.....	Pillar	#8½ Right #3 South	136,809	260	**526.2**	No	45°
Sept.–Oct. 1957.....	Pillar	#8 Right #3 South	44,174	79	**559.2**	Yes	45°
Nov. 1957.....	Pillar	#8 Right #3 South	20,198	39	**518.0**	No	45°
Dec. 1957–March 1958	Solid	#7½ Right #3 South	54,376	121	**449.4**	Yes	—
April–Oct. 1958.....	Pillar	#7½ Right #3 South	111,087	179	**620.6**	Yes	Flat

Full Pillaring With the Boring-Type Miner

By **C. M. Hoard**
Division Superintendent, Marion Div., Bethlehem Mines Corp., Barrackville, W. Va.

And **C. S. Cressman**
Chief Engineer, Coal Div., Bethlehem Mines Corp., Johnstown, Pa.

OVER 620 TONS PER SHIFT in a 6-mo period, compared to an average of 376 tons in the early weeks of operation, reflect the success attending application of a boring-type miner to pillaring at Mine No. 41 of the Bethlehem Mines Corp., Barrackville, W. Va. In the initial 34 mo of operation, also, experience resulted in the adoption of slabbing as the key method of attack, a change from a 45-deg to a flat pillar line, and the adoption of a rope-frame panel belt to cut delay time to the absolute minimum.

Profile, Mine 41

Mining at No. 41 is done in the high-volatile Pittsburgh seam. Average coal thickness is 96 in. The immediate roof averages 12 in of draw slate overlain by 12 in of wild coal. The main roof is a sandy shale. Overburden cover ranges from 250 to 650 ft.

Four miner units and four conventional trackless units operate two shifts daily and one conventional trackless unit operates three shifts daily. Mine cars carrying 3.4 tons of coal are hoisted in a two-compartment shaft. Sixty-five percent of the coal is loaded directly into railroad cars as clean coal, with the remainder going through a cleaning plant before loading.

Main haulage locomotives convey the coal to the bottom from the sections, picking up a train of empty cars on the bottom and returning them to the sections. Main line haulage is on 60-lb track; section haulage, 40-lb.

Power for the No. 1 section area of the mine is supplied by a 300-kw rectifier operating from 2,200-V AC supplied through a borehole from the surface. One positive and one negative cable, each 1,000,000-cir mil capacity, are hung in the section (see Fig. 6). One positive cable is for miner use only. The 6/0 trolley is for the remaining equipment on the section and haulage. The negative feeder coupled with the bonded track provides the negative side of the power circuit. This is the only face unit operating in this area of the mine.

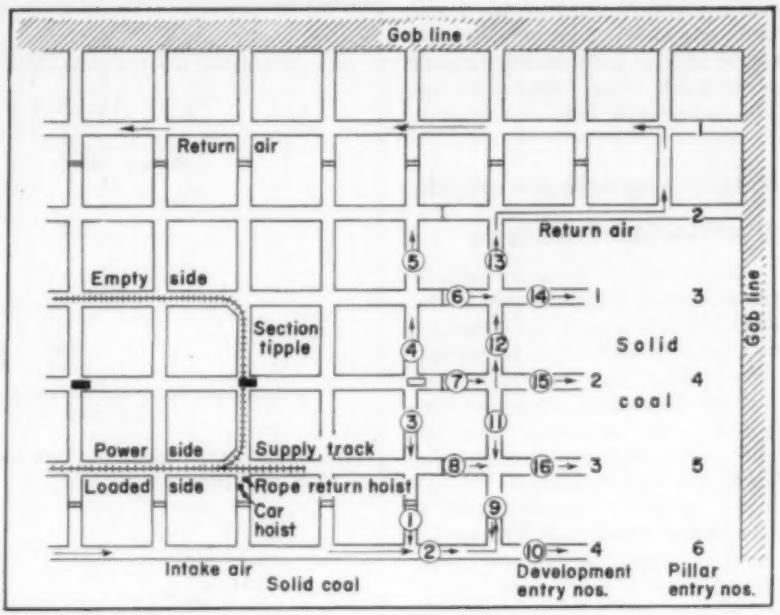

FIG. 1–MINE 41 DEVELOPMENT PLAN provides for four-block panels, with mining squarely on the face and butts of the coal.

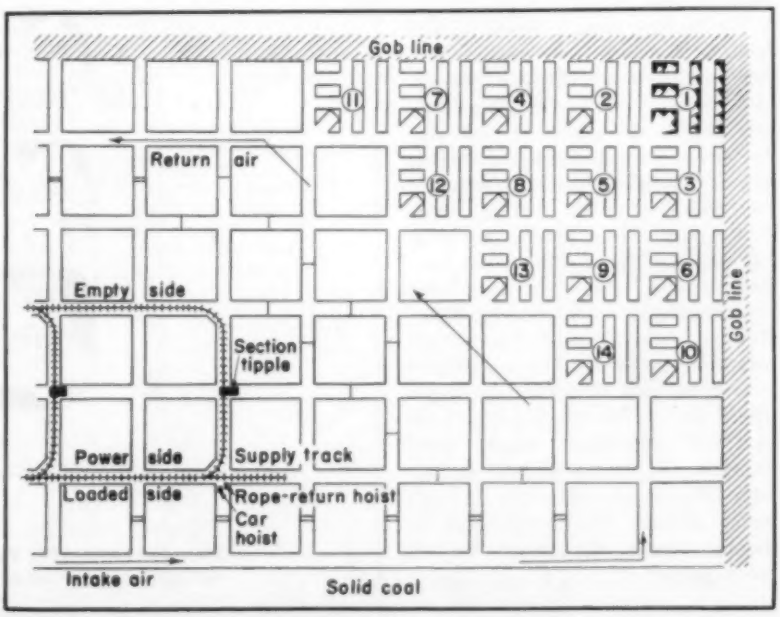

FIG. 2–ORIGINAL PILLARING PLAN based on use of a 45-deg line with rail haulage to the section tipple.

Panel Development

As shown in Fig. 1, solid development is done by four-block panels. Four headings 14 ft wide are developed with conventional equipment. The blocks are driven on 90-ft centers, thus leaving 76-ft-square pillars. Mining is done squarely on the face and butts of the coal. Section moves are made in two-block increments, both on advance and retreat.

Track circles for section loading ramps are advanced and retreated each two blocks and span two blocks. Track on development is laid in Nos. 1 and 3 headings with the tipple in No. 2. On retreat, the track headings are re-numbered as 3 and 5, with the tipple in No. 4. This is because two blocks from previous development are picked up on the left side.

The power heading in development is No. 3, which leaves it farthest away from the pillar line on retreat.

Present plans call for development with conventional equipment and rope-frame belt conveyor. Upon completion of development the miner will take over pillaring. Conventional development work is roof-bolted throughout. Rock dusting on development is done manually on shift and by portable dusters on the off-shift, followed by high-pressure main-line dusters as the section is advanced. Blanket dusting is done manually in No. 1 and No. 4 headings. With the rope-frame belt setup, power remains

in No. 3 with the belt in No. 2 and track only in No. 3 for access to the section for man trip cars, supplies and maintenance. Four miner units are now operating in full pillar work.

Miner Experience With Shuttle-Car Haulage

On Jan. 23, 1956, a boring-type miner was put into operation in No. 1 section to complete the remaining development work. This type of machine was new at this mine, and manufacturer's representatives helped train operating personnel while the remaining twelve pillar blocks were developed. Miner helpers took over operating jobs on subsequent installations. The following is an account of pillaring operations before a panel belt was installed Aug. 23, 1957. The operation of the other three units paralleled this system, except for a flat rather than angle pillar line.

The section crew consists of one assistant foreman, one miner operator, one miner helper, one shooter-roof bolter, one brattice-pipeman, two shuttle-car operators and one tippleman. Section equipment consists of one boring-type miner, one utility car equipped with bolters, three shuttle cars (one a spare), one loading machine (for grading when necessary), one cable coal drill, one rope hoist and one rope-return hoist. Coal is loaded directly into shuttle cars from the miner. The shuttle cars convey the coal to the section tipple where the coal is dumped into mine cars. A tippleman checks cars, changes rope, cleans spillage and rotates shuttle-car operators through lunch periods. The bratticeman or shooter rotates the miner through lunch periods.

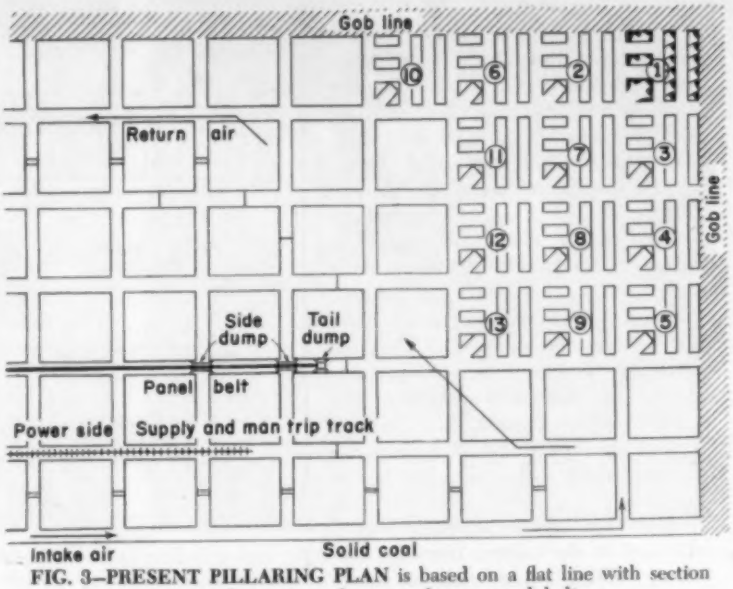

FIG. 3—PRESENT PILLARING PLAN is based on a flat line with section service by means of a rope-frame panel belt.

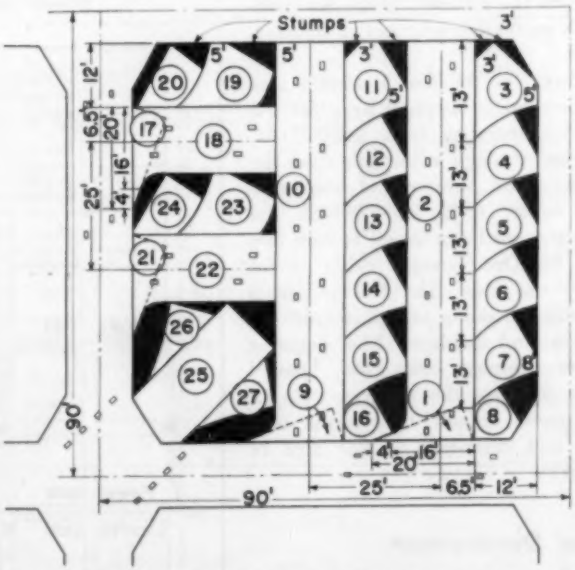

FIG. 4—STANDARD PLAN for breaking off pillar splits and slabbing. Average recovery of the 76-ft pillar blocks is 76%.

Slabbing Adopted

It was first decided to use the standard conventional method for recovering pillar blocks. This called for alternating face and butt splits and final mining on the point of the block. After a few blocks were mined it was apparent that some alterations were necessary to take fullest advantage of the potentialities of the machine.

Two long face splits and slabs were mined first because the miner will advance more rapidly with the coal breaking more freely from the face cleavage planes. This shortens the splits on the harder-cutting butt side of the block at right angles to the cleavage planes. Miner tramming time and cable handling time also were shortened.

A slab 12 ft thick eventually proved to be most satisfactory for maintaining support in pillar splits and providing maximum coal without exposing the operators beyond the rib line of the slab cut. After two face splits are completed the two butt splits are completed and the block is finished on the point. Mining height in pillar work is 7 ft; in solid development the full mining height is upped to 7½ ft.

As pillar work progressed it was evident that roof pressures from overlying strata in the surrounding mined-out areas would over-ride into the

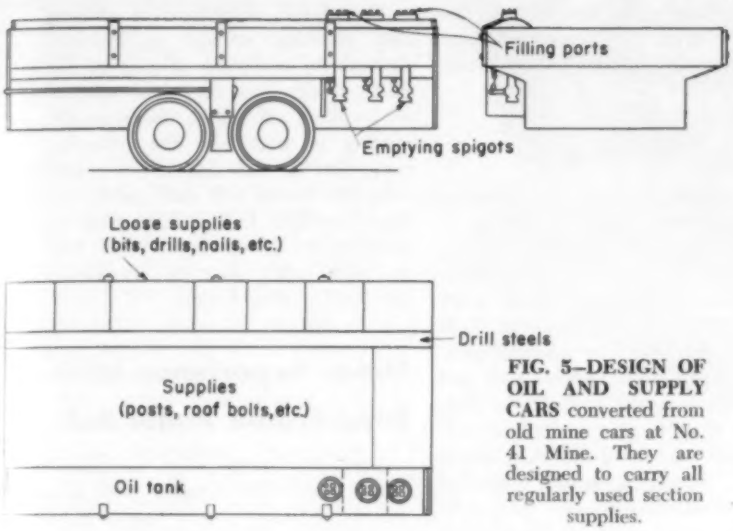

FIG. 5—DESIGN OF OIL AND SUPPLY CARS converted from old mine cars at No. 41 Mine. They are designed to carry all regularly used section supplies.

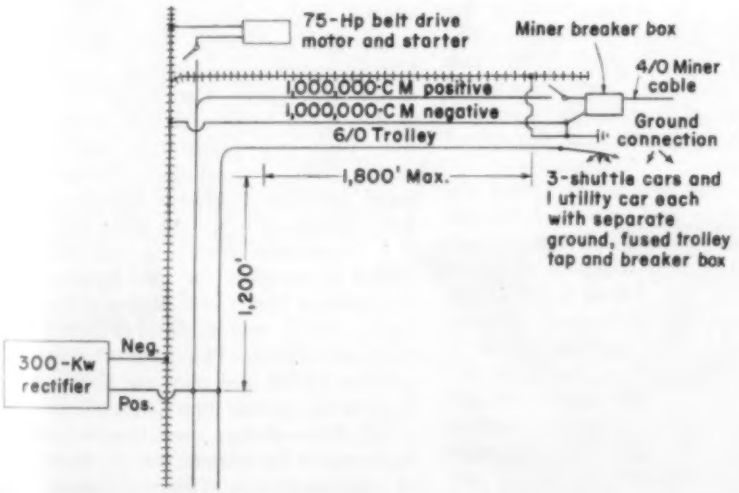

FIG. 6—POWER SYSTEM for continuous-miner section.

pillar splits unless relieved. The arches provided ample strength for the load, but the short level span cut by the top bar of the miner buckled from the load or became drummy. To overcome this situation, stumps in the immediate mined-out split were drilled and shot to promote falls. This proved the value of continued good falls in successful pillaring with the boring-type continuous mining machine.

Flat Line Adopted

As in conventional mining, a staggered pillar line, 45 deg to the cleavage planes of the coal, was established as shown in Fig. 2. A change to an essentially flat line was made, as previously noted, in February, 1958, as shown in Fig. 3. The miner starts in No. 1 block on the left side and completes a single series of blocks with No. 4 block on the right side. After the series is completed, the miner moves back to No. 1 block and works up the line through No. 4 again. As each two series of blocks are pillared out, the section power and haulage are retreated two blocks. Other mining procedures remained unchanged.

Controlling Direction

As was expected, some difficulty was experienced at first in driving a straight split 76 ft long. But this is considered vital to successful pillaring. Various methods were tried before falling back on the old tried and true, with small variations. The engineering corps installs the initial sighting roof spads at the mouths of the four splits. A length of cord with wire hooks on each end and a small weight in the middle is hung from the two sighting spads. A reflector target is placed on the top cutter bar of the machine on the operator's side.

The miner helper and operator take three sights in each 10 ft of penetration. A chalked cord is snapped against the roof on the three points and the sight line is painted with yellow paint. This procedure is carried through to the completion of the split and gives both operators and foremen a continuous check on lateral alignment.

A hydraulic coal drill is mounted on the rear deck of the miner. The miner operators and helper drill roof holes at regular intervals and periodically check the bottom at the face for vertical alignment. Operators have at least 1 ft leeway vertically because mining height was dropped to 7 ft. This also enables the machine to clear roof bolts in starting new pillar splits.

Supplying Air and Water

Air is brought in on the right (operator's) side with line brattice. The line brattice is fastened to the rib with spads, both top and bottom. The 6-ft-wide brattice cloth is kept approximately 2 ft off the pavement and clear of the trailing cable and water hose. This also puts the brattice cloth at the belly of the arch and gives maximum area for air flow. When slabbing operations begin in the split the line brattice is taken down as the miner retreats. Regular face ventilation was found to be sufficient

for the short splits on the butt side of the block.

A home-made cable and water hose carrier was constructed from two pieces of 1¼-in pipe 25 and 5 in in length. The 5-in length, called the guide, is welded to the longer pipe at right angles 6 in from one end. The carriers rest in rib holes drilled below the line brattice about 18 in off the pavement. The cable and water hose are placed between the guide and the rib when the pull is away from the rib, and on the outside of the guide when the pull is to the rib. This makes a smooth sliding surface for the cable and hose.

Fifty-foot lengths of quick- coupling 1-in air-type hose carry water to the miner from a 2-in section water line. The hose is handled on the carriers along with the 4/0 miner trailing cable. Hose is added or taken off as the miner advances or retreats. This type hose was selected because it will withstand rigorous use, does not kink easily and can be quickly coupled or uncoupled. When the miner moves the hose is uncoupled from the machine and recovered after the miner is located in the next block. Hose is installed into the new blocks before miner moves.

Handling Trailing Cables

Handling the size 4/0 miner trailing cable was at first a time-consuming task. However, moves are now made within the 36-fpm tramming time of the machine to the next working place. A changeover from flat 4/0 miner cable to round trailing cable was made to reduce kinking and facilitate handling.

Enough cable and water hose are brought up to mine a block to completion. This is stored at the mouth of each face split on the slab side. From this point the cable feeds into the split on the aforementioned carriers. As the miner starts the second face split the cable is dropped back to the mouth of this split on the slab side. When the miner is on the butt side the cable is in the idle crosscut on the face side.

The cable is pulled back in readiness for the coming move to the next block while tramming back for final mining on the point of the block. All section personnel are used when moving to the next block and handle the cable manually. On longer moves across the section the cable is dragged by shuttle cars. A ½-in manila rope is tied around the cable and snubbed to the shuttle car. The rope will break before any damage is done to the miner trailing cable, should tension become abnormal.

Removing the Pillar

A standard method for breaking off pillar splits and slabbing (Fig. 4) was initiated and is carried out on all miner sections. First, the miner is trammed to the breaking-off point of the pillar split. This point is 20 ft from the slab line. The miner is positioned at an angle which will put both arms into the coal at the slab line. It then begins a straight run and mines coal until the slab line is reached. Then the miner is pulled back and starts into the split 4 ft inby the initial start, or 16 ft from the slab line.

In this operation the operator turns the machine on the smallest radius possible. A turn made in this way has several advantages. The slab line is established, shuttle cars have ample turn clearance, a minimum area of coal has been opened, and turns are standard throughout the mine.

After the turn is completed the miner drives straight through the pillar block to the gob. It then pulls back 19 ft and begins a slab cut, turning on the smallest possible radius until it holes through to the gob. The machine then is pulled back 13 ft from the start of the first slab cut and begins the second slab cut, again being turned on the smallest-possible radius until the miner holes through to the gob.

Three more slab cuts are made at 13-ft intervals. This completes mining in the split to the large front stump, which then is mined from the heading. Two hardwood posts, precut to 6-ft 7-in lengths, are set with 3x5x18-in cap pieces upon completing each lift in the block. Two posts are set in the heading on the slab side of the split.

The miner now trams back and begins the second face split. After the miner has penetrated approximately one-third of the distance through the pillar block, the shooter and the bratticeman, in the presence of the foreman, drill the stumps created by the driving of the first face split as necessary. The stumps are then shot immediately to promote a fall and relieve roof pressures.

This same procedure of drilling and shooting stumps is followed through to complete mining of the pillar block, and the same method of breaking off splits, slabbing and posting is used with the following exception: A half slab cut is mined after the initial full slab cut in the short butt lifts. In final mining on the point of the block, eight posts, four on each side, must be set before this final mining begins.

Miner Experience With Rope-Frame Panel Belt

Time studies in pillar work have shown that sufficient miner work time was available to permit use of three shuttle cars. In development work the studies showed that miner work time was fully extended by two shuttle cars. This was primarily because of the harder cutting in development work, particularly when mining at right angles to the cleavage planes in the butt places. Car-change time at the section tipple and rope-change time were two undesirable delays, along with comparatively longer trams and less roadways associated with mining on a 45-deg pillar line.

A rope-frame conveyor was installed to complete the nine remaining series of blocks of a 45-deg pillar line in No. 1 section. Several delays were eliminated. The third shuttle car was added and mine-car change time at the section tipple was eliminated. Rope change time cannot be improved at the present time because of mine-car design. Two side dumps were built at the mine for belt operation and supplemented the tail dump.

Lack of shuttle-car haulways became critical with the accelerated mining resulting from installation of the third shuttle car. A flat pillar line would provide necessary roadways and shorter hauls but a flat line had never before been successful in conventional mining. After considerable planning and discussion it was decided to try a flat line since only one block at a time would be opened up by the miner. The flat line was successful and the final delay was eliminated.

Section operation with rope-frame

belt and a flat line remains essentially the same, also the method of attacking a pillar block. Section personnel is increased by one shuttle-car operator. The section tipple is moved out to the main haulage. These are the major changes.

Supplies

Section supplies are placed on the section supply track on the off-shift by a supply crew which serves all the mine sections. Posts, rock dust, blocks, sand, cement, etc., are loaded into ordinary mine cars. Old mine cars were cut down, as shown in Fig. 5, and built into section supply cars.

Two cars are assigned to each section. The supply crew places one each night and takes the other outside to be resupplied. These cars were designed to carry regularly used section supplies, such as: roof bolts, shin plasters, roof-bolt boards, drill steel, rock-drill bits, cutter bits, stoper oil, transmission oil, hydraulic oil and other supplies as needed.

The hydraulic- and transmission-oil tanks are supplied from two 10,000-gal tanks in the outside mine yard. The stoper oil tank is filled manually. The tanks hold 35 gal of hydraulic oil, 10 gal of transmission oil and 3 gal of stoper oil, respectively. All supply orders pass from the section foreman through the mine foreman, then to the outside foreman.

Maintenance

Major repairs and inspection are carried out on the off-shift. Procedure is as follows: The midnight maintenance foreman reviews day-shift and night-shift section reports. One first-class and one second-class repairman are called in to discuss the section report and plan the work program. They are assigned a mine jeep on which they load parts, tools and grease. Grease comes into the mine in 52-gal drums and is stored in the oil house at the motor barn. It is then transferred into a 5-gal milk can, the lid put on and the can loaded onto the jeep. A 2-gal can of degreasing solvent also is loaded.

The jeep is parked at the end of the supply track. The second-class mechanic fills a high-pressure foot-operated grease gun. He takes the gun to the miner and greases it throughout.

There is a stand on each section

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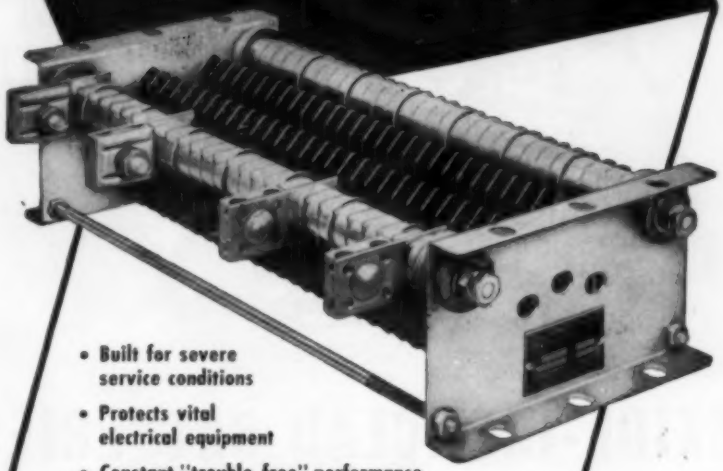

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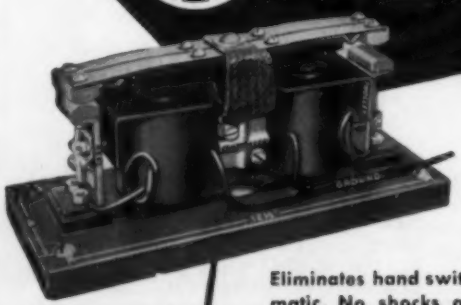

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with three milk cans for grease, hydraulic oil and transmission oil. The transmission-oil can is painted red so that it is distinguished from the hydraulic-oil can. The mechanic then fills the hydraulic and transmission cans from the section supply car and completes lubrication of the miner.

Hydraulic oil is pumped into the miner with a small manual gear pump mounted on the miner. A 15-micron filter precedes the pump. Two 15-micron filters and one magnetic filter are on the suction side of the hydraulic circuit.

An oil gun is used to service miner transmissions.

The oil cans then are returned to the stand. Cans are cleaned each night before use. The section grease supply is replaced by the new can brought from the bottom and the old can is taken back to the motor barn.

This mechanic then sets bits on the miner. He next visits each piece of equipment to grease conveyor drives and idler sprockets, and add hydraulic oil where needed.

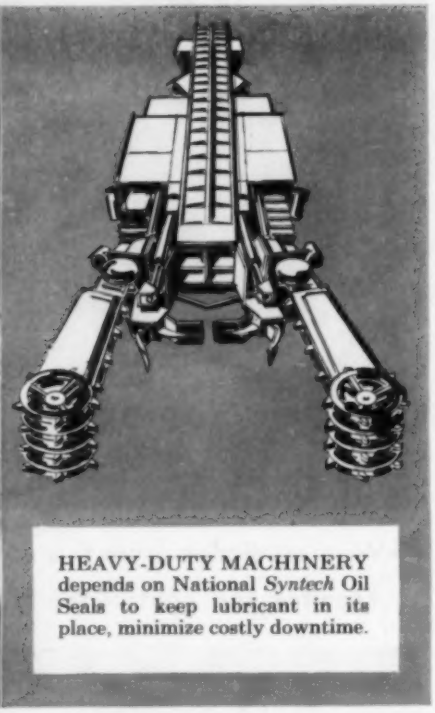
Shuttle cars receive an overall greasing and transmission oil once weekly. The utility car is greased throughout weekly. The loading machine is lubricated nightly when used. The tail piece is greased every other night. The drive unit is greased every other night and checked each night for leaks.

The first-class mechanic first makes necessary repairs on the miner. He cleans all miner filters (water and oil) weekly, washing them in a solvent. All miner arm bolts are tightened nightly. Contactors, motors, sprockets, trimmer chain and crawler drive are checked for adjustment nightly. Transmission bolts are checked for tightness. Brushes on the 100-hp and 50-hp motors are checked weekly. A regular inspection program is carried out on all section equipment as a step in a preventive maintenance program.

Coming Next Month . . .

The April issue of *Coal Age* will carry a full preview of the 1959 American Mining Congress Coal Show to be held at Cleveland, May 11-14. This special section in April will provide a roundup of new equipment to be shown, the full program of the technical sessions and tips on how to get the most out of the show. Take the April issue to Cleveland with you.

Better products, *faster,* from your Bearing Specialist:



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National "prescription-blends" a synthetic just right for the heavy-duty oil seals you need

National *Syntech* Oil Seals feature: 1. Synthetics "prescription-blended" to meet specific operating conditions; 2. Minimum tension on garter spring to reduce shaft-torque, increase seal life; 3. Accurately sized O.D.'s.

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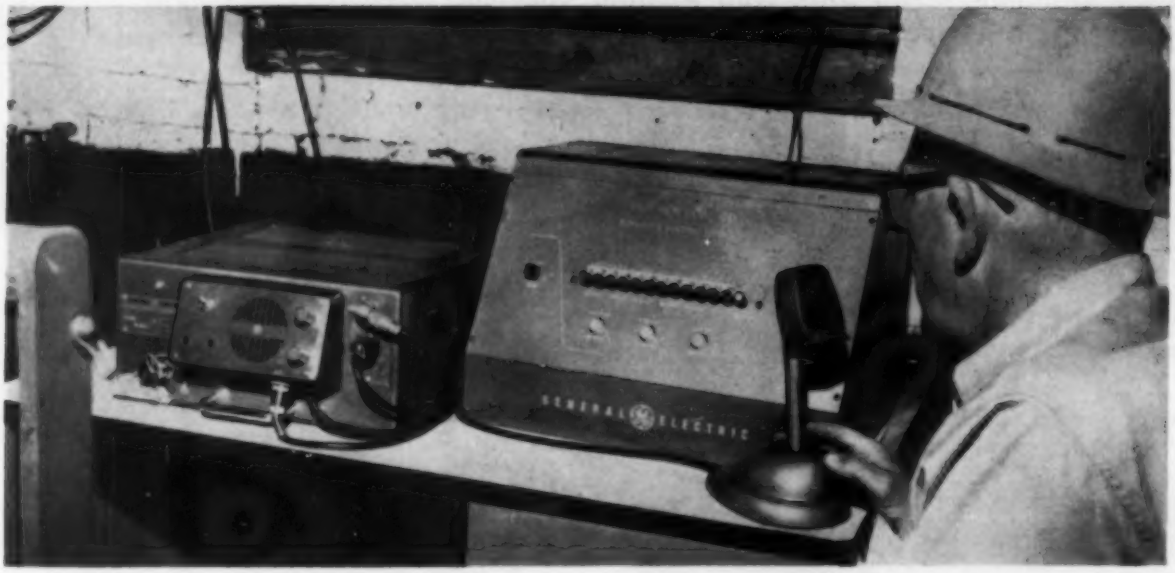
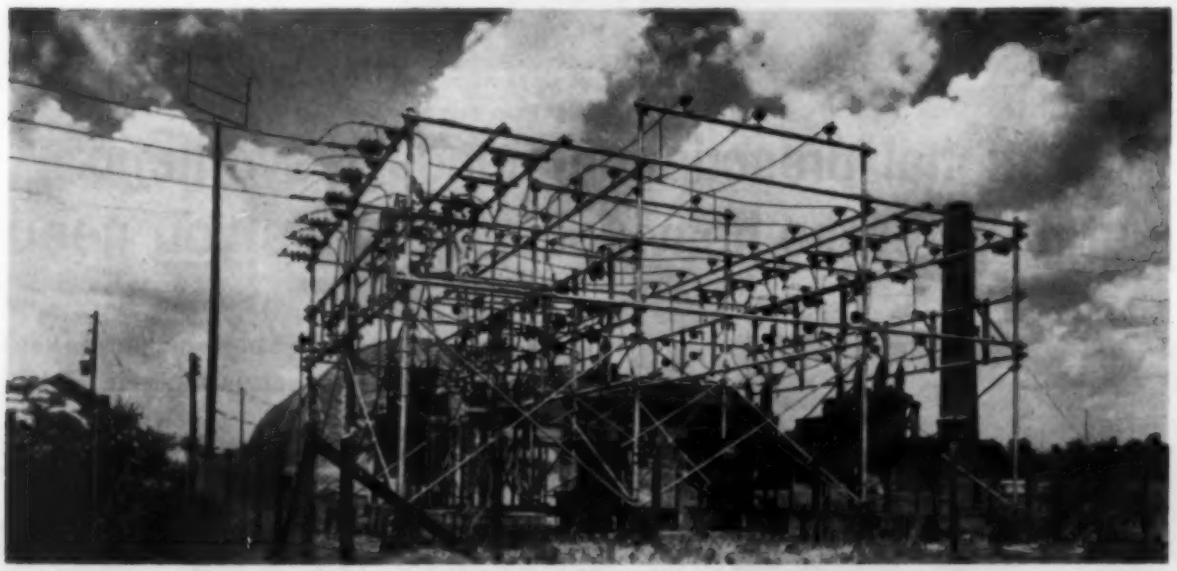


▲Wireless signals from this control station at Old Ben's No. 14 mine . . .
Monitor and control the high-voltage switchgear at this remote substation. ▼



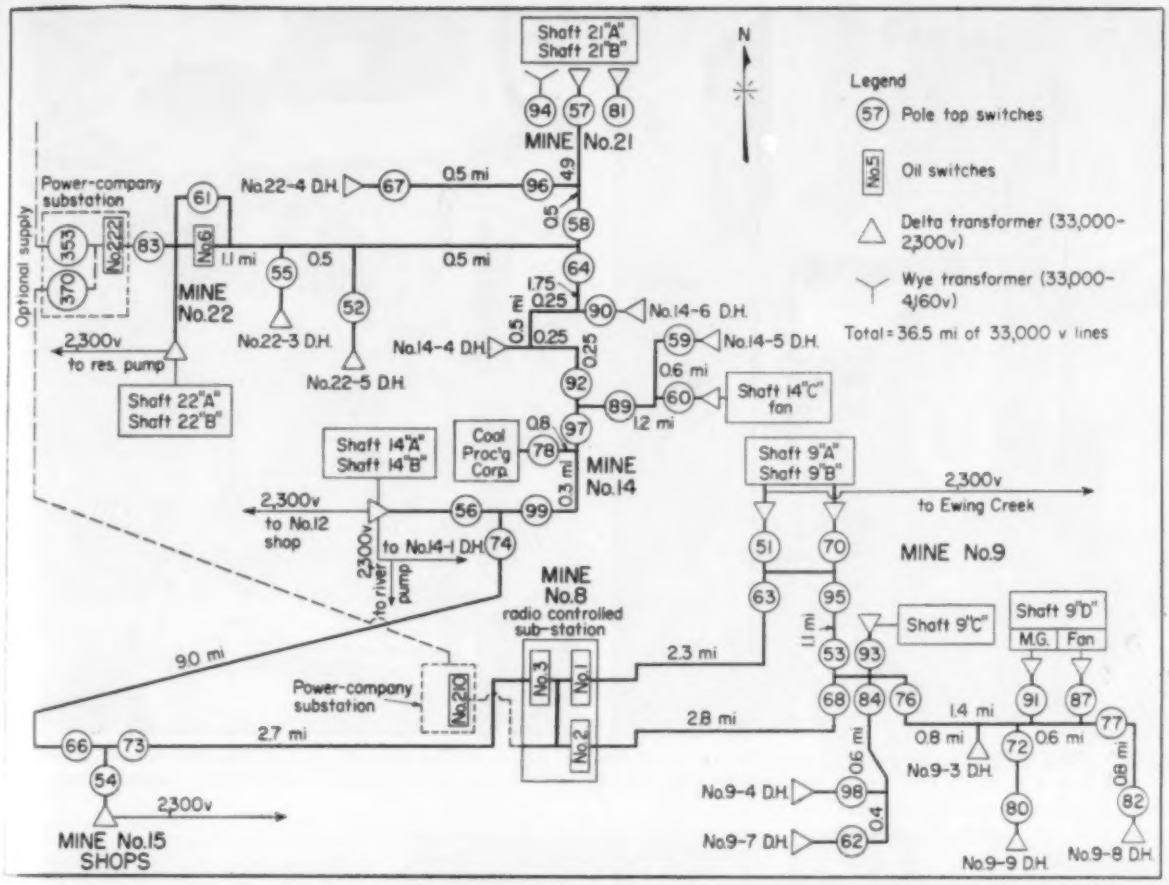
Wireless Control of 33,000-V Power

Old Ben Coal Corp. employs two-way radio to monitor and control three circuit breakers at main substation.

IN A CAPE CANAVERAL-type application of two-way radio, Hollis Pierce, electrical engineer of Old Ben Coal Corp., directs the distribution of 33,000-V, AC, primary power over 36.5 mi of transmission lines from a console at one of the company's mines. Essentially, this wireless system permits the operator at Old Ben's Mine No. 14 to control or monitor the operation of three main circuit breakers at Mine No. 8, which is 8 mi away.

The background is this:

Electrical energy for all Franklin County, Ill., operations of Old Ben is delivered by Central Illinois Public Service Co. to the coal company's main substation at Mine No. 8, near West Frankfort. However, No. 8 was recently abandoned, confronting the



POWER-DISTRIBUTION SYSTEM at Old Ben provides for alternate routes to prevent outages of lengthy duration.

company with a Hobson's choice of moving the substation to one of the active mines or providing round-the-clock attendance at the No. 8 site—unless someone could come up with a real bellringer of an idea as a third choice. Radio-monitoring of the substation was just that kind of an idea.

It works like this:

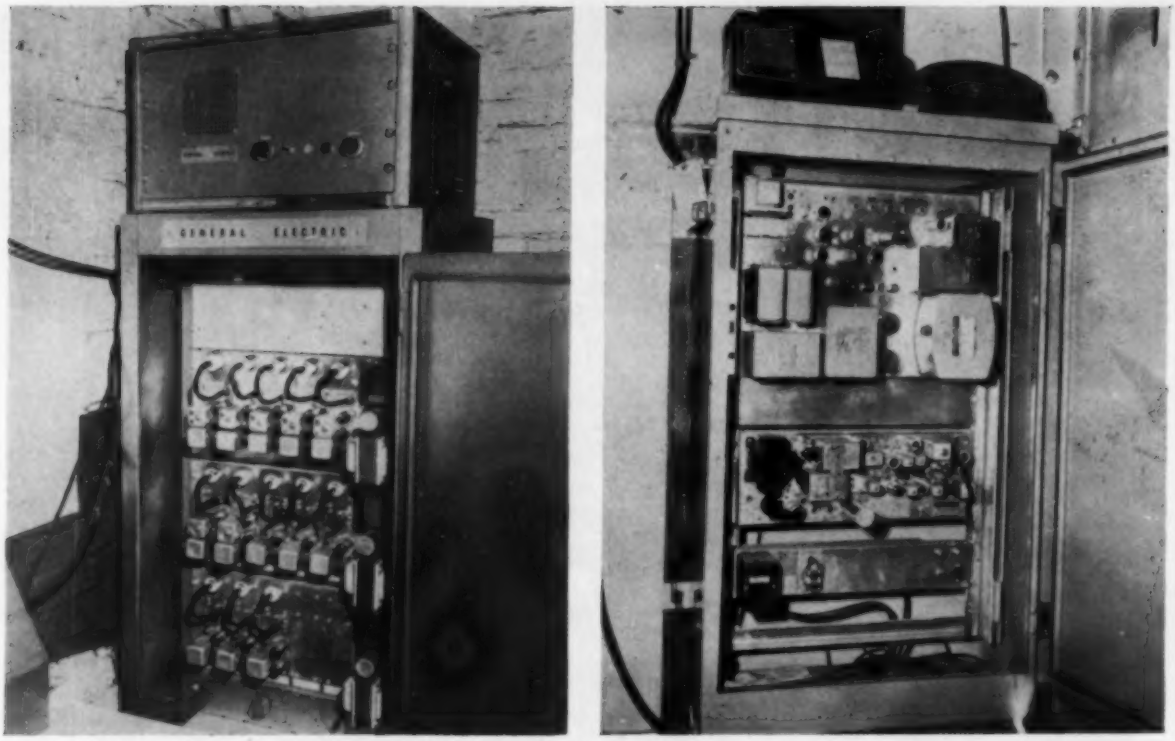
The cabinet at the control end (Mine No. 14) contains tone receivers and tone transmitters that operate in association with the monitor-and-control console, as shown in an accompanying illustration. The cabinet at the remote end (Mine No. 8) also contains tone receivers and tone transmitters. In essence, Old Ben's radio monitoring consists of this: The tone transmitters at the control station send an interrogating "beep" to the tone receivers at the remote station. The remote receivers then actuate relays to check conditions at the circuit breakers and to relay the resulting intelligence back through the remote-station transmitters to the control-station receivers. The reply signal from the remote station provides an audio signal and operates indicating lights on the console at the control station at Mine No. 14.

The main substation at Mine No. 8, which houses the remote station of the radio-monitoring system, is the single metering point for the company's power network. This is the main reason why it was undersirable to move or decentralize the installation.

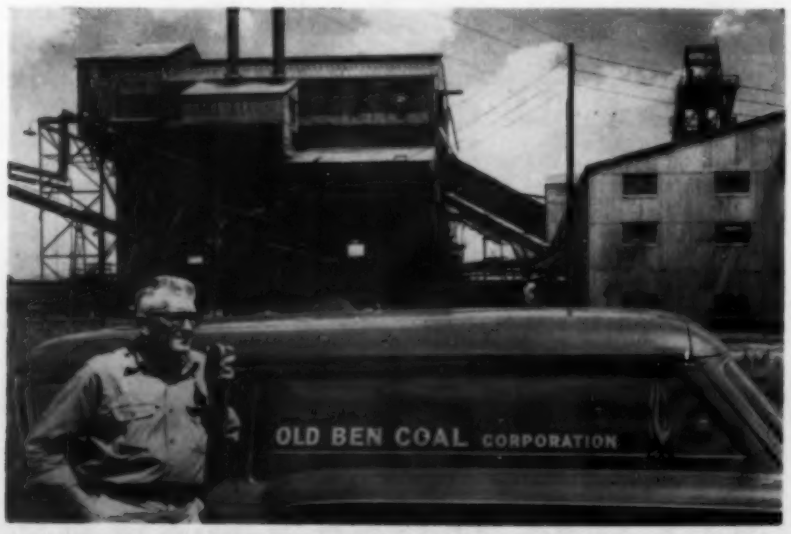
Special characteristics of circuit-breaker operation also are monitored by the two-way radio system. For example, the oil-filled breakers are opened or closed by compressed air supplied by a small compressor at the substation. If for any reason the air pressure falls below the safe value required for operation of the breakers, the remote tone transmitters beam this information to an indicating light on the control-station console. In addition, a horn sounds outside the control station to summon one of the surface supervisors. It is not necessary, even at the control station, to have a full-time attendant.

Another special consideration which must be provided for is the operation of the automatic reclosers on the main circuit breakers. The reclosers are set to perform one 55-sec cycle in which three attempts are made to automatically reclose the breaker. Old Ben's power-distribution standards stipulate that not more than one such cycle should be performed, since the fault apparently is not self-clearing if the breaker is not closed after three attempts by the recloser. Therefore, the console provides three push buttons which by means of radio signals can lock out the recloser circuits of the three breakers at the remote station. Thus the breakers can be remotely opened without having the reclosers try to close them again. Then incoming power can be switched to optional transmission lines, as shown in the distribution diagram, until the fault in the main lines can be cleared.

Another provision is a system-checking arrangement. When a system check button on the console is depressed all indicating lights are extinguished. This also initiates a sequence of tone queries from the control station to the remote station. A memory drum in the remote station



RADIO COMPONENTS at control station (left) and remote station (right) are in cabinets designed for easy maintenance and replacement of parts. Unit on top of control-station cabinet is 72.94-mc receiver which picks up remote-station signals.



VIA TWO-WAY MOBILE RADIO, Electrical Engineer Hollis Pierce receives information on possible electrical troubles and instructs control station operator in steps to be taken to correct the trouble or to reroute power.

cabinet rotates through a series of contacts to check all conditions and functions of the circuit breakers and automatic reclosers, and causes replies to be beamed back through the remote transmitters to the control station receivers. The indicating lights in the console buttons come back on to the accompaniment of "beeps", indicating that the monitoring system is operating properly.

Three other buttons on the console operate the three circuit breakers at the remote station. This makes it possible to switch incoming power from the main lines to optional lines by means of wireless signals from a distance of 8 mi.

To insure continuity of operation of the monitoring system, a battery of cells has been installed in the control and remote stations to provide standby power at 110 V.

Other refinements include the outside alarm, as mentioned, which may be silenced by an alarm reset button on the console. This button also extinguishes "momentary" indicators which light up in the event of ordinary momentary changes. The alarm sounds on momentary changes.

All this equipment is auxiliary to the conventional two-way radio system already in use at Old Ben. One of the portable sets is installed in Mr. Pierce's car. One of the base sets is installed at the control station of the monitoring system at Mine No. 14. This makes it possible to contact Mr. Pierce at any of the properties, from where he can advise a man at the control station of the steps to take at the console push buttons to clear a power-distribution problem. The result is rapid correction of power outages.

The transmitter at the control station operates at a frequency of 154.49 megacycles, and the transmitter at the remote station at a frequency of 72.94 mc. The information to be transmitted from either end is converted into a predetermined combination of two simultaneous audio tones which is superimposed on the carrier signal.

CENTER OF OLD BEN OPERATIONS and of radio system is this new headquarters at Benton, Ill.

Using the combined audio tones in highly selective networks virtually eliminates the possibility of having the equipment operate as a result of ambient sounds.

The new facilities for wireless control of power transmission were developed with the aid and counsel of George A. Strunck, vice president—operations. Mr. Strunck's early experience with Old Ben was in the capacity of electrical engineer.

All equipment is furnished by General Electric Co. The unit assemblies, such as, power-supply packs and tone transmitter and receiver panels, are mounted in cabinets which provide front and rear access for maintenance. Mr. Pierce says the equipment requires only normal radio maintenance.

This particular application of monitoring by two-way radio is another first for Old Ben, the company that

- first used rockdusting continuously as a means of controlling mine explosions;
- first adopted the compulsory use of electric cap lamps in Illinois;
- first employed two-way radio communication between underground locomotives in southern Illinois, and
- first employed Cardox on a commercial basis.

The company's latest project is the development of a new mine, No. 21, near Sesser, Ill. The shafts have been completed and construction of the surface plant is now underway. The acreage available to the new mine contains in excess of 100,000,000 tons of Franklin County coal.

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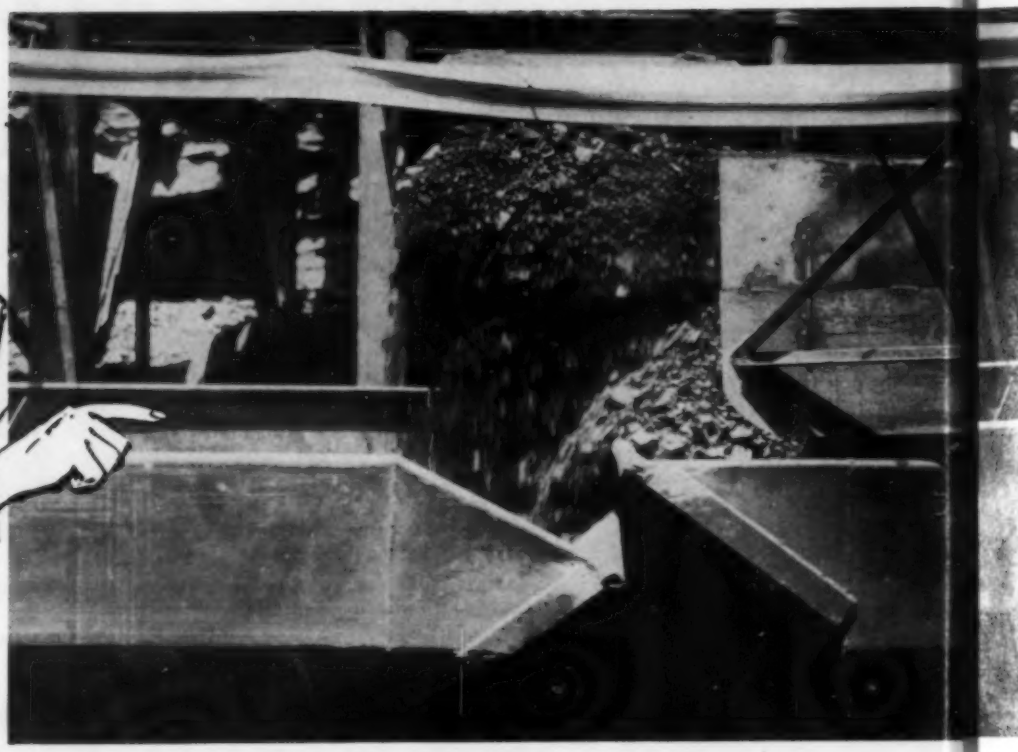
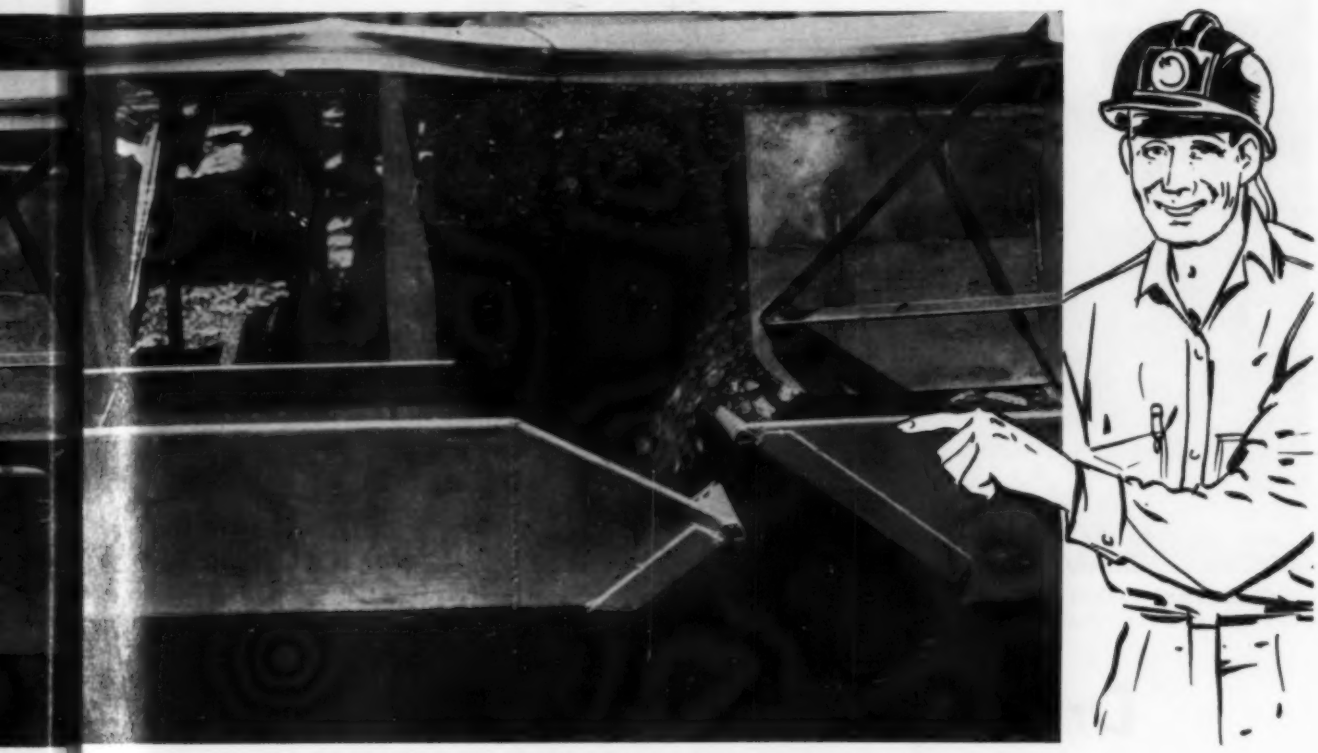
"Here, in unretouched pictures, why S-D Automatic 'Overlapping haulage cost to the



Note coal continues to flow from chute directly over exclusive S-D Automatic "Overlapping Ends" — without spillage between-cars. Photographer shot this picture while trip was in-movement.

This still-shot shows the Top Dresser Bar and Side Dresser Plate, which automatically dress the cars as they are automatically loaded!

is shown one of the basic reasons End' Cars will reduce your absolute minimum..."



We had chute discontinue loading at the moment this picture was shot so you could see that in actual operation two things take place: (1) as mentioned, flow of coal continues uninterrupted and also (2) after dressing car to underground haulageway height, surplus coal is plowed into next car in trip—thanks to S-D "Overlaping Ends."

EVERY YEAR, without exception, more mines convert to the S-D Automatic Car Haulage System. What are the reasons?

1. Since the mining operation at the face and the preparation of coal for shipment are separate and distinct functions, operators want them to be carried on independently, so that each may operate in the most economcial manner . . . in other words, so that no interruption or slow down in one will interrupt or slow down the other. They want the system that will continuously remove coal from the loading point as it is mined, and, at the same time, will provide a continuous supply for the preparation plant. Automatic Bottom Dumping Mine Cars are the only known means of low cost coal mine transportation that will allow a continuous movement of coal from the face, or loading point, to the railroad car. Reason for this is because these cars are the only method of haulage that can use a low cost, low maintenance, large capacity SURGE BIN, which serves as a temporary storage for coal in transit and thereby balances the mining and preparation operations.

Automatic Dumping ON-THE-MOVE!

2. Lower initial capital cost — 40% fewer cars required . . . fewer locomotives . . . rotary dump requires special dump at high cost . . . cleaning plant may be of smaller capacity because it does not have to handle all the coal as quickly as it is mined.

3. Lower operation cost — fewer cars, fewer locomotives . . . no rotary dump to operate and maintain . . . no dumping labor, and with S-D "Overlapping End" Cars no loading labor!

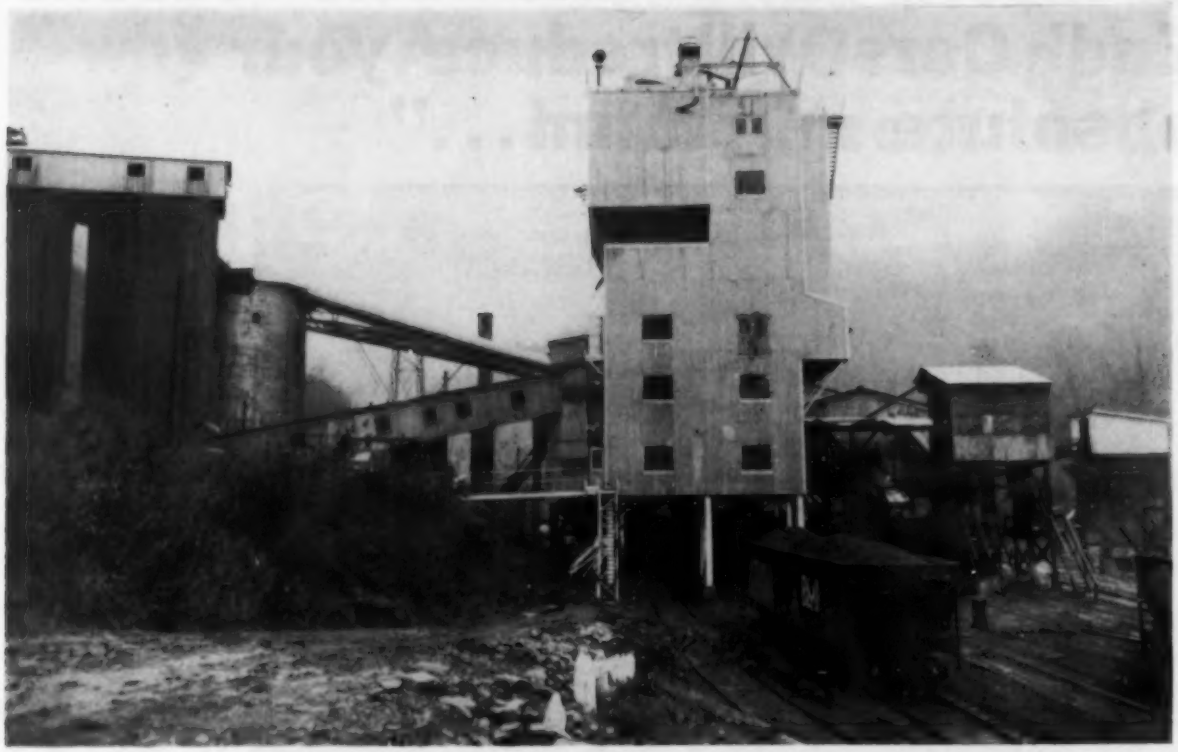
4. Greater flexibility — cars of any size and dimension can be dumped over same SURGE BIN, provided each has same track gauge, of course. Double tracks can be used over bin where desirable. No tilting chutes or other similar mechanisms required at loading points; therefore, less headroom and less capital cost, plus minimum time required for moving loading set-up! No other coal haulage system gives the flexibility provided by Automatic Bottom Dumping Car Transportation!

These are some of the fundamental reasons why the S-D Automatic Bottom Dumping Car Haulage System reduces cost to the absolute minimum. How much can you save? We recommend a fact-finding survey by our Application Field Engineer. No obligation, of course. May we get together? Write or call us today!

Sanford-Day Iron Works, Inc., Knoxville, Tenn.

SANFORD-DAY

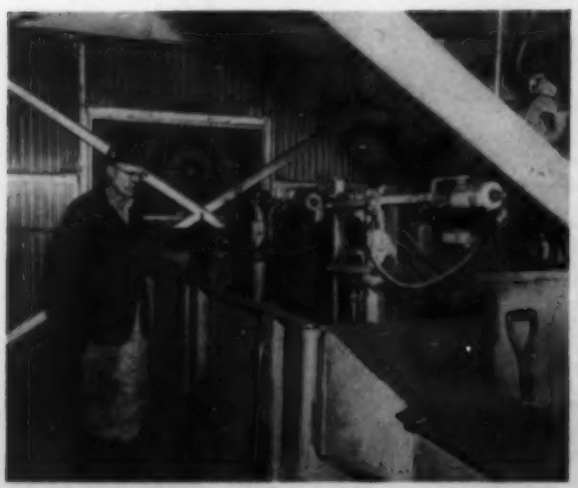
KNOXVILLE, TENNESSEE



PREPARATION FACILITIES at Johnstown's No. 4 mine include a new fine-coal cleaning plant (foreground) and original washing and sizing plant. Three storage bins at left have a combined capacity of 1,200 tons for storing R-O-M coal.

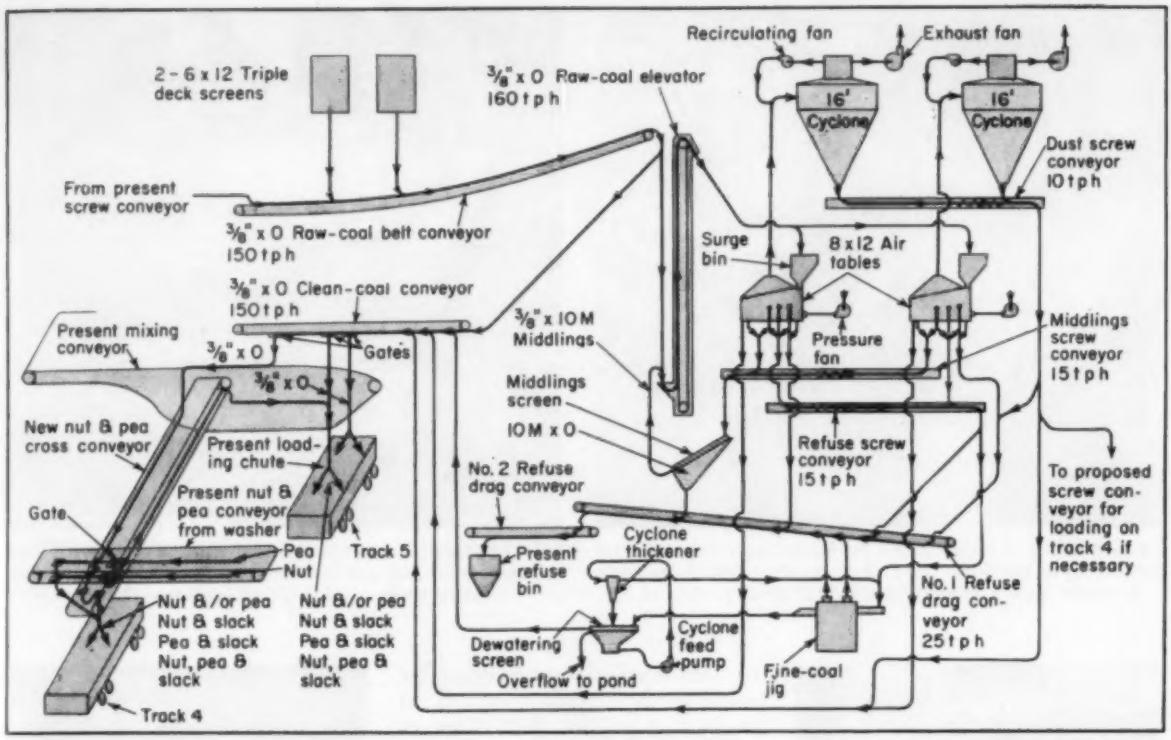
Dry Cleaning and Washing Fines

New fine-coal dry cleaning and auxiliary wet washing facilities enhance Johnstown Coal & Coke Co.'s market position. These facilities permit shipping an accurately screened 3/8x0 product averaging three percentage points lower in ash.



NEW FINE-COAL WASHER is used to rewash secondary refuse from two 8x12 air tables. Capacity of unit is 15 tph.

SECONDARY REFUSE from air tables is checked by Garry Ridder, chemist. Product is rewashed in auxiliary wet washer.


Recirculating fan
Exhaust fan
2 - 6 x 12 Triple deck screens
3/8" x 0 Raw-coal elevator 160 t p h
16' Cyclone
16' Cyclone
Dust screw conveyor 10 t p h
From present screw conveyor
3/8" x 0 Raw-coal belt conveyor 150 t p h
Surge bin
8 x 12 Air tables
3/8" x 0 Clean-coal conveyor 150 t p h
Present mixing conveyor
3/8" x 0
Gates
3/8" x 10M Middlings
Pressure fan
Middlings screw conveyor 15 t p h
3/8" x 0
Middlings screen
10M x 0
New nut & pea cross conveyor
Present loading chute
Refuse screw conveyor 15 t p h
No. 2 Refuse drag conveyor
To proposed screw conveyor for loading on track 4 if necessary
Present nut & pea conveyor from washer
Gate
Cyclone thickener
Present refuse bin
Pea
Nut
Track 5
No. 1 Refuse drag conveyor 25 t p h
Nut & /or pea
Nut & slack
Pea & slack
Nut, pea & slack
Nut & /or pea
Nut & slack
Pea & slack
Nut, pea & slack
Cyclone feed pump
Dewatering screen
Overflow to pond
Fine-coal jig
Track 4

COAL FLOW in new fine-coal cleaning plant. Dry cleaning and rewashing of secondary air-table refuse are featured. Additional conveyors provide extra loading points and blending.

at Crichton No. 4 Mine

STABILIZATION OF QUALITY was the major objective of the Johnstown Coal & Coke Co. in installing fine-coal cleaning facilities at its No. 4 preparation plant at Panther Gulch, W. Va. The resultant high-grade ⅜x0 product, featuring a 3-point reduction in ash percentage, enables the company to participate in the metallurgical and other quality-consumer markets at home and abroad.

The dry coal cleaning and auxiliary wet washing facilities feature a new 2-cell ORC fine-coal washer manufactured by the Ore Reclamation Co., Picher, Okla., and sold by Heyl & Patterson, with a capacity of 15 tph for washing secondary air-cleaner refuse. The primary units are two 8x12 R&S Super-Airflow cleaning units having a maximum input feed of approximately 150 tph of ⅜x0 coal. Other equipment consists of two 16-ft diameter Raymond cyclone dust collectors equipped with Crites tubes and 12-in double-flap discharge valves, three 8-in Heyl & Patterson cyclone thickeners and two Allis Chalmers single-deck Aero-Vibe screens.

The No. 4 plant, served by the Baltimore & Ohio R.R., handles 400 tph of coal from the Sewell seam. Coal is brought to the surface by a R-O-M belt conveyor and is discharged directly onto a raw-coal conveyor for cleaning and sizing. As an alternative, coal can be stored in three Neff & Fry cement-slab-constructed storage bins having capacities of 300, 400 and 500 tons each. Each bin is equipped with a conveyor for discharging stored coal back onto the R-O-M conveyor.

The new cleaning plant for upping the quality of the ⅜x0 fraction, was designed and constructed by Roberts & Schaefer Co. It contains approximately 8,000 sq ft of floor space. The building is covered with corrugated aluminum. All starters are by General Electric and are housed in a pressurized control room. Reliance 440-V motors are standard.

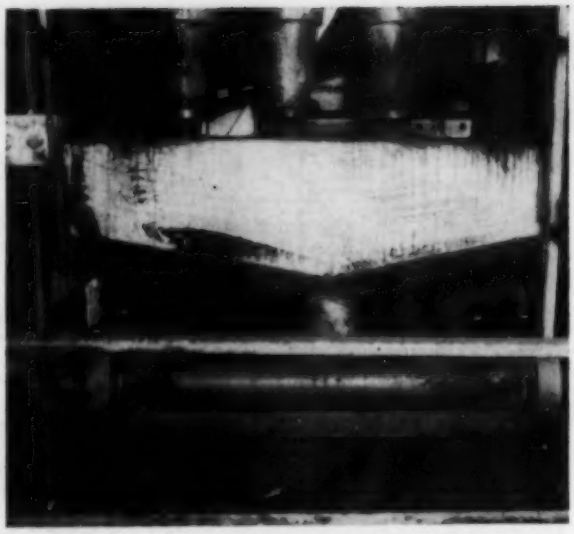
Performance of the Fine-Coal Jig on ⅜x0 Secondary Refuse

Specific Gravity	Weight, Percent	Ash, Percent	Cum. Ash, Percent
Raw Feed			
Float 1:45	85.62	2.98	2.98
1:45–1:60	3.42	24.95	3.82
Sink 1:60	10.96	77.83	11.93
	100.00		
Clean Coal			
Float 1:45	97.00	2.37	2.37
1:45–1:60	2.42	23.43	2.88
Sink 1:60	0.58	41.93	3.11
	100.00		
Reject			
Float 1:45	6.09	7.97	7.97
1:45–1:60	7.54	31.42	21.44
Sink 1:60	86.37	78.52	70.67
	100.00		

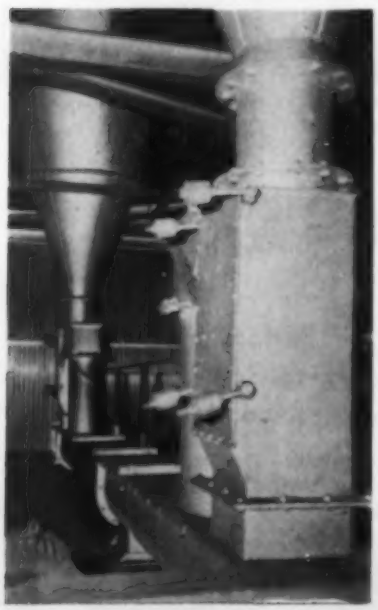
Coal Flow

Raw ⅜x0 coal from the main plant is discharged onto a 150-tph belt conveyor from two 6x12 triple-deck Ripl-Flo vibrators. At the trans-

CLEAN COAL from air tables discharges onto drag conveyor for loading or blending. The final product is checked constantly to insure quality products and overall plant performance.



DEWATERING SCREEN (bottom) receives clean coal from jig. Dewatered coal goes via chute to clean-coal conveyor and ½-mm slurry is pumped to three 8-in cyclones.



DUST CYCLONES discharge material through double-flap valves onto conveyor for delivery to clean-coal or refuse.

PRESSURIZED CONTROL ROOM reduces maintenance of starters. Air unit (right) filters dust and reduces moisture.

fer point of the raw-coal conveyor, coal can bypass the dry cleaning plant through a chute to the clean-coal conveyor or discharge into a 160-tph Jeffrey elevating conveyor which delivers coal by means of a bifurcated chute to two 30-ton surge bins. Each bin discharges coal to two 8x12 Super-Airflow cleaning units.

The surge bins are equipped with Bindicators which show full and low bin levels, and also an auxiliary for indicating the approach of full-bin condition. A full bin over either air table will stop the flow to the plant. However, a flop gate in the elevator discharge chute is equipped with limit switches which permit the plant to run until both surge bins are full. If the bins are empty a low-level Bindicator operates an indicating light on the pushbutton panel board. A different-colored light indicates a full bin. The auxiliary full-bin indicator warns the operator at the plant raw-coal belt head that the bin is approaching full. One man operates both the wet and dry preparation plants.

Clean coal from the air tables is collected on a drag conveyor for loading into railroad cars or blending. Middlings are collected by screw conveyor and carried to a 3x8 single-deck Aero-Vibe vibrating screen which separates 10-mesh material. Plus 10-mesh is recirculated to the air tables by the raw-coal elevator. Minus 10-mesh goes by chute to the refuse drag conveyor.

Secondary refuse from the air tables is collected by screw conveyor which discharges material into the ORC fine-coal jig. Clean coal from jig is sluiced to a 3x8 single-deck Aero-Vibe dewatering screen and then to the clean-coal conveyor by chute. Slurry (1/2-mm) from the dewatering screen is pumped to three 8-in cyclones mounted directly above the dewatering screen. Thickened product is returned to the screen and overflow is recirculated through the fine-coal jig. Reject from the jig drops to the refuse drag conveyor via elevators built into the jig. Primary refuse from air tables is discharged to the refuse drag conveyor.

Dust from the air tables is collected by two cyclones, which discharge through a 12-inch double-flap valve, onto a screw conveyor for delivery

CONTROL OF RAW-COAL FEED to surge bins is accomplished by new-type indicators which signal plant operator.

QUALITY CONTROL is of first concern at Johnstown Coal & Coke Co. All analyses are performed at the company's laboratory located near the preparation plant. Direct communications aid in handling prescription orders and analysis requests.

to the clean-coal or refuse conveyor.

The cyclones are equipped with Crites tubes to increase efficiency of the cyclones and also to exhaust cleaner air. The tube is located in the center of the cyclone and inside the regular exhaust pipe. It extends past the regular exhaust and is adjustable to permit raising or lowering it to achieve the best performance. Material picked up by the Crites tubes is recirculated through the cyclones.

Dust also is collected at three locations in the existing plant to improve working conditions and reduce clean-up and maintenance cost. Points of collection are at the transfer stations of the R-O-M and raw-coal conveyors, at the raw-coal conveyor and scapling screens, and at the two Ripl-Flo vibrators where 3/8x0 coal is separated for cleaning.

Refuse from the fine-coal plant is discharged onto a secondary refuse conveyor and carried to the refuse storage bin for disposal by trucks.

Fine-Coal Jig

The ORC jig is designed to prepare fine coal in the 3/8-in to 60-mesh sizes. It can be used to wash raw coal for clear-cut gravity separation or as a secondary unit for rewashing refuse from other cleaning systems, as at Johnstown's No. 4 plant. Performance on 3/8x0 secondary refuse at the No. 4 plant is shown in the accompanying float-and-sink table.

Dimensions of the 2-cell washer are as follows: length, 8 ft 9½ in; width, 5 ft 9 in; height, 9 ft 8 in. The washer is equipped with individual dewatering refuse elevators driven by separate 1-hp motors.

Refuse gates are automatically operated by air and are adjustable to control the opening of refuse draw-off. Throat gates can be raised or lowered for uniform water distribution. Weir gates can be raised or lowered to control depth of material in washer. In addition, sieve screens can be lowered to create a permanent bed or tilted to speed up or retard the flow of the refuse bed.

Supervisory Personnel, Mine No. 4, Johnstown Coal & Coke Co.

J. J. Resick, General Manager.
Ben Auld, Preparation Engineer.
P. W. Galeener, General Superintendent.
Louis Fyock, Superintendent.
Joe McCue, Tipple Foreman.
Garry Ridder, Chemist.
Howard Gwinn, Mine Clerk.

Mixing Conveyors

The clean-coal conveyor from the fine-coal plant is equipped with three rack and pinion gates at the discharge end. The first gate directs coal to Track No. 5 for loading into railroad cars. Coal discharged through Gate No. 2 goes to the bottom strand of the existing mixing conveyor for loading on Track No. 5 or for mixing with other products carried by the mixing conveyer for loading on Tracks 1, 2 and 3. The third gate delivers coal to the top strand of the mixing conveyor. A trough carries the 3/8x0 product from the top strand of the mixing conveyor to the nut and pea conveyor. The top strand of the nut and pea conveyor mixes the 3/8x0 with the nut and/or pea for loading on Track No. 4. The bottom strand of the nut-and-pea conveyor receives the nut and/or pea coal from a 2-compartment across-track nut and pea conveyor from a 6x14 Allis Chalmers vibrator. These products are delivered to the bottom strand of the mixing conveyor for loading on Tracks 1, 2, 3 and 5.

The mixing conveyor is reversible and basically, with it carrying from No. 1 to No. 5 track, any product made for loading on Track Nos. 3 and 4 made be carried to No. 5; also with the new layout slack in varying quantities may be carried to Track No. 4 by operation of the third gate noted in the preceding paragraph. By reversing the mixing conveyor any size normally loaded on Track Nos. 3, 4 and 5 may be carried to Nos. 1 and 2, thus providing the advantages of additional loading points when lump is being crushed and recirculated, or if egg is being crushed at which time Track Nos. 1 and 2 would otherwise be idle.

MAUMEE COLLIERIES

At the Maumee Collieries in Indiana . . .

ANACONDA SHOVEL CABLE HAS A RECORD: 10 YEARS ON THE ROCK PILE!

Anaconda's SH-D Cable gives many years of dependable service in spite of heat, moisture, kinks, rocks and runovers!

How many shovel cable hazards can you count in this picture from the Maumee Collieries? Rocks . . . moisture . . . kinks . . . danger of runovers—they're all there. Yet the first installation of Anaconda's rugged SH-D Shovel Cable has resisted them all—*for 10 long years!*

It's proof again of the way Anaconda's in-the-field experience with Shovel Cable pays off in a superior cable for you. The important knowledge gained from use and testing of SH-D Cable *on the job* in our own mines goes into the design and manufacture of Anaconda Shovel Cable.

For example, the insulation is Anaconda Butyl (AB). Nothing can beat it for withstanding ozone, heat and moisture. Patented rubber cores cushion the ground wires and help prevent breaks from kinks and runovers. SH-D has a neoprene jacket that is exceptionally tough and abrasion-resistant. And every design, every component has been job-tested—your assurance of superior quality and performance.

Call on the Man from Anaconda with your cable problems. Or see your local Anaconda distributor. For new descriptive Bulletin DM-5818, "Anaconda Securityflex Portable Cables for the Mining Industry," write: Anaconda Wire & Cable Co., 25 Broadway, New York 4, New York.

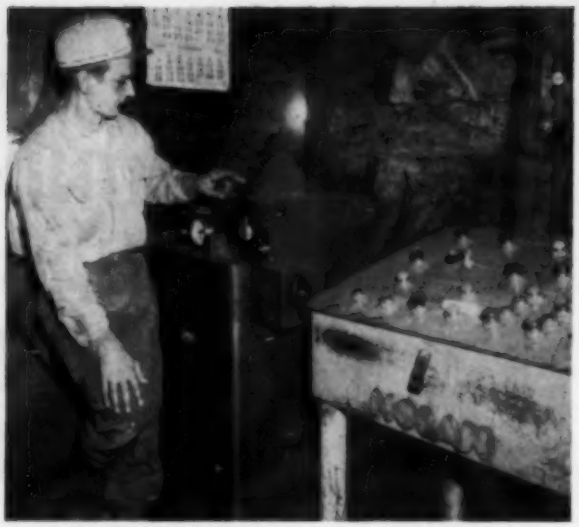
For a decade, the Anaconda SH-D Shovel Cable you see here has been giving dependable service for the Maumee Collieries, Jasonville, Indiana. Its many superior design features enable it to resist on-the-job hazards that would knock out ordinary shovel cables.

ASK THE MAN FROM

ANACONDA®

FOR **SHOVEL CABLE**

ROTARY DUMP unloads 12 tons from each car. Feeder under dump hopper delivers raw coal to a 30 x 54 single-roll crusher.



SIMPLIFIED WEIGHING is achieved with electronic tape recorder, identifier and automatic totalizer.

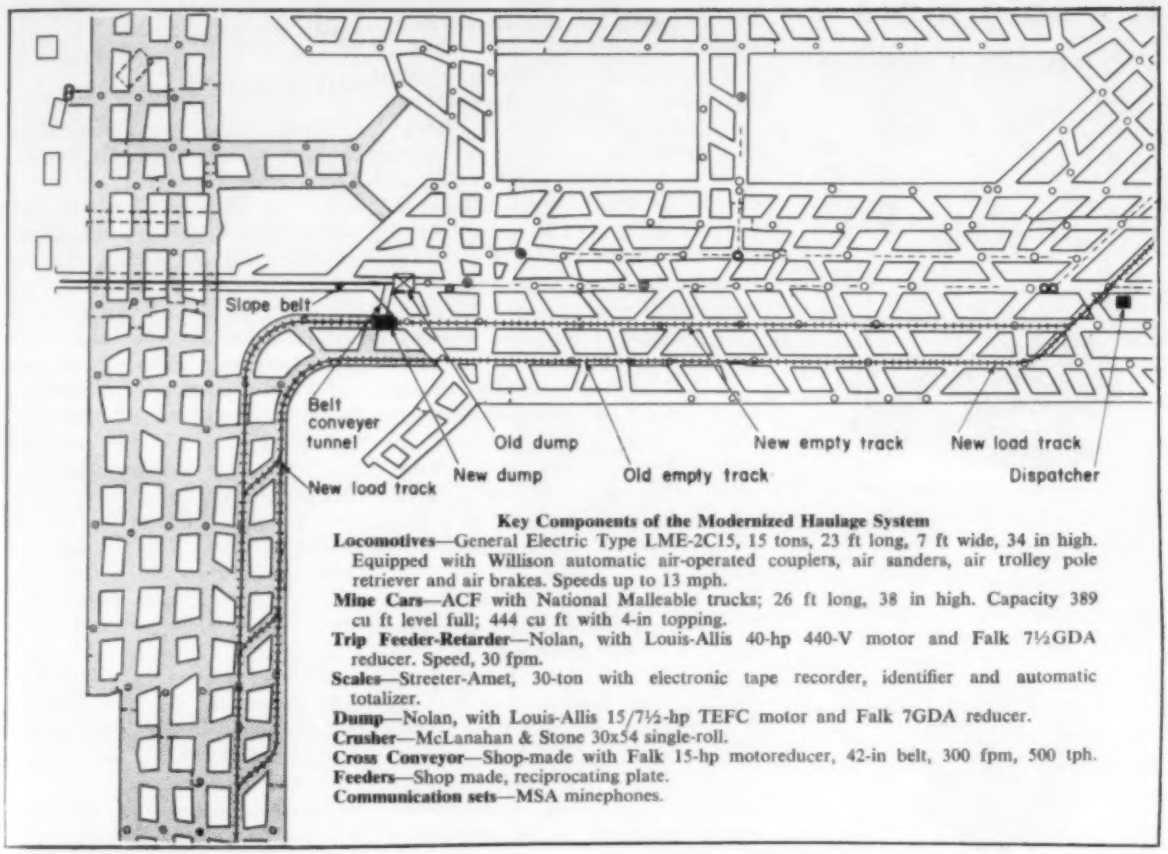
Modern equipment, better controls boost haulage efficiency

CONTROL of underground transportation system is centered in dispatcher's office located beside main haulage road.

DUMP DRIVE with 15-hp motor has shaft extending both ways (arrows) to driving gears at each end of dump.

15-TON LOCOMOTIVE is coupled to each end of 20-car trip. Units have automatic couplers and communication set.

REMOTE CONTROL of electrically operated track switches helps speed movement of locomotives and cars.



Key Components of the Modernized Haulage System

Locomotives—General Electric Type LME-2C15, 15 tons, 23 ft long, 7 ft wide, 34 in high. Equipped with Willison automatic air-operated couplers, air sanders, air trolley pole retriever and air brakes. Speeds up to 13 mph.

Mine Cars—ACF with National Malleable trucks; 26 ft long, 38 in high. Capacity 389 cu ft level full; 444 cu ft with 4-in topping.

Trip Feeder-Retarder—Nolan, with Louis-Allis 40-hp 440-V motor and Falk 7½GDA reducer. Speed, 30 fpm.

Scales—Streeter-Amet, 30-ton with electronic tape recorder, identifier and automatic totalizer.

Dump—Nolan, with Louis-Allis 15/7½-hp TEFC motor and Falk 7GDA reducer.

Crusher—McLanahan & Stone 30x54 single-roll.

Cross Conveyor—Shop-made with Falk 15-hp motoreducer, 42-in belt, 300 fpm, 500 tph.

Feeders—Shop made, reciprocating plate.

Communication sets—MSA minephones.

NEW LAYOUT at slope bottom includes rotary dump, recording scale, cross conveyor, crusher and sidetracks.

A 47% slash in haulage cost and a 51% reduction in dumping expense result from . . .

Modernized Hauling and Dumping

HAULAGE COST SLASHED 47% and dumping cost cut 51%—these are the results of completely revamping and modernizing haulage and dumping at the No. 25 mine of the Island Creek Coal Co., Ragland, W. Va. Hand in hand with these savings are a 53% reduction in haulage manpower and a 58% cut in dumping manpower.

The company also notes a great reduction in track and haulage maintenance costs. There are fewer wrecks, less spillage of coal along roadways and, consequently, fewer men and less material are needed to maintain haulways. An added benefit is elimination of delays at the preparation plant resulting from large pieces of rock, which are now broken up by a new underground crusher.

Island Creek's new haulage and dumping system is the latest step in a program designed to completely modernize No. 25 mine. The mine was opened in 1948 as a mechanized operation employing track-mounted loaders, which discharged directly into mine cars. When the mine was opened, 700 4½-ton end-dump mine cars were purchased to haul 4,000 tpd in two shifts.

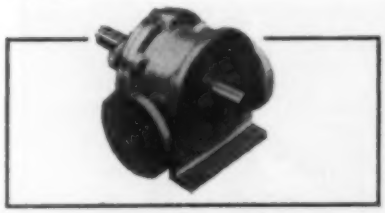
Track-mounted loading machines were used until 1953, when the company started converting to off-track equipment. The changeover was completed in 1954. As machine operators became skilled in the operation of the off-track machines, production per section increased. This increase in production was so great that a bottleneck developed in the haulage system. Hence the full benefit of the high-capacity equipment could not be realized.

But this condition was not destined to continue long because Island Creek engineers were analyzing and evaluating the mining, transportation and dumping systems to break the bottleneck and at the same time come up with the most efficient haulage and dumping installation possible for the No. 25 mine.

About the time the engineers were designing the new haulage system, a new problem came up when a rock parting in the coal seam became thicker and, as a result, larger pieces of rock became more numerous in the raw coal. These heavy, sharp pieces caused trouble along the slope belt and delays in the preparation plant. To eliminate these troubles management decided to include an underground crusher in

It's so simple—
when you need
a pump *Call*

Gathering Type PLUNGER PUMP—dependable, light, compact. Has many uses. Pipe connections are brought into proper position by reversing suction and discharge chambers. 42" long, 17" wide, 22" high, weight (less motor) 260 pounds.



High Pressure SPRAY or FIRE PUMP—round stainless steel rollers prevent clogging and jamming by coal and dirt particles. Uses less power—friction is reduced. Produced in various capacities—10 GPM at 100-125 PSI for spraying. 50 GPM at 50 PSI for fire needs.

CENTRIFUGAL PUMPS highly rated for complete reliability and service. All sizes to 8" discharge and 1500 GPM. In acid-resisting bronze or stainless steel.

PUMP REPLACEMENT PARTS for practically all types and makes of centrifugal and plunger pumps.

FLOOD CITY
BRASS & ELECTRIC CO
JOHNSTOWN, PA.

Sales Agent: Kanawha Rail & Machinery Co., Charleston, W. Va.

the haulage modernization program.

Today shuttle cars feed coal to big 26-ft-long all-steel 12-ton ACF mine cars equipped with Willison automatic couplers, rubber draft gear and National Malleable trucks. Coal is delivered to the new rotary dumping station in 20-car trips which travel over 60- and 85-lb rails laid on 5x7-in Osmose-treated ties. A General Electric 15-ton locomotive is used on each end of a trip as a safety measure. All switches at main intersections are operated by Canton remotely controlled electric switches.

A Nolan feeder-retarder, driven by a Louis-Allis 40-hp motor operating through a Falk 7½GDA reducer, delivers cars to a Nolan rotary dump at the rate of 30 fpm. The dump is driven by a Louis-Allis 15/7½-hp TEFC motor connected to a Falk GDA reducer.

As cars approach the rotary dump, they are weighed by a Streeter-Amet scale equipped with an electronic tape recorder, identifier and totalizer. One man controls the car feeder, dump and scale from a central pushbutton station adjacent to the scale. The electrical controls for the feeder and dump are interlocked with the controls for the preparation plant.

The automatic recorder enables the operator to operate buttons which code each section's coal by letter and number as it passes over the scale. The code number is transferred to a tape along with the weight of each car. After the last car in a trip from one particular section passes over the scale, the operator pushes a totalizer button which records the total weight of all the cars in the group. This subtotal and each following subtotal for groups of cars from other sections are recorded on special cards which are placed in the electronic machine each time a subtotal is needed. When a card is put into the machine, it operates a punch which stamps the proper section code and the subtotal weight.

At the end of each shift cards are taken to the mine clerk who then has only three or four subtotals for each section to add to get the total production for each shift and section. Since the underground automatic weighing and recording station has been in use, the company estimates that five man-hours a day are saved. Before the new facilities were installed, car weights had to be recorded individually by hand on a master sheet at the scale.

Making the Changeover

Work on the new dump, feeder, crusher and track started early in 1956 and was carried on without interfering with coal production. It was completed during the miners' vacation in 1956. During the construction period the mine and preparation plant worked two full shifts per day and some of the underground sections worked three shifts.

To make possible construction of the new dump without interfering with production, the company chose a location in a heading adjacent to the old dump. To prepare for the new dump, scale and tracks, new headings were driven northward from the slope bottom and then turned eastward and westward to open a new main entry for future development.

The site chosen for the new dump is 60 ft from the old dump and near the old empty track. This location was picked so that a minimum of excavation and concrete work would be needed to make a connecting link between dump and slope belt.

To provide room for the new car feeder, scales, dump and crusher it was necessary to excavate to a depth of 50 ft. Then a tunnel was driven 60 ft from this opening to intersect the slope. This connecting tunnel was fitted with a transfer slope belt.

Drilling, blasting and rock loading into mine cars were done during the two regular coal-producing shifts. Rock was dumped on the third shift and hauled to the surface on the slope belt.

After the excavation work was completed, 484 cu yd of concrete was poured around the new dump area. Ready-mixed concrete was dropped 460 ft to the mine through a 5-in pipeline in a borehole. The 1:2:4 mixture landed on a chain conveyor where it was thoroughly remixed as it was carried 30 ft to the construction site.

To test the strength and uniformity of the hardened concrete, test borings were made of the initial pour. Results showed that the hardened concrete met the required standards. Consequently, all the concrete was delivered through the borehole.

⅛-inch cord was the primer used with oil-soaked Spencer N-IV Ammonium Nitrate for this blast.

The 28,000 pounds of Spencer N-IV Ammonium Nitrate is now ready for shooting the overburden blast at Calaveras.

Forty 9-inch holes, each containing 700 pounds of material, are shot simultaneously.

27,000 cubic yards of material were moved with such good fragmentation there was no need for secondary shooting.

Progressive Calaveras Cement Company shows how to . . .

Save $7.00 To $10.00 Per Ton Of Blasting Material:

Big saving in priming costs plus greater blast energy make new Spencer N-IV most efficient, low-cost blasting agent:

The easiest, most economical blasting method known is now cutting costs and speeding up blasting operations in the Calaveras Cement Company quarry at San Andreas, California. By using new Spencer N-IV Ammonium Nitrate, they are able to save about $7.00 to $10.00 in priming costs per ton of material used.

Different from any prilled ammonium nitrate now on the market, Spencer N-IV reduces priming costs because it can be initiated with a single strand of ⅜-inch detonating cord. There's no need to attach additional material at intervals, or employ other complex priming methods —and you don't have to store high explosives on the job site!

The superior blast effect and easier detonation of Spencer N-IV are the result of a special structure which allows the prills to absorb oil more easily. Combine this with the fact that Spencer N-IV contains a much higher percentage of ammonium nitrate than other brands, and you can see why N-IV gives consistently better fragmentation.

Completely free-flowing for easy loading, Spencer N-IV is packaged in 50-lb. polyethylene plastic bags, as well as 50, 80 and 100-lb. multiwall paper bags. Two years of tests have proven that the polyethylene bags are tougher than paper and can reduce bag breakage as much as 50%. No more trouble with leaking oil—and these bags are so moisture-proof they can actually be stored out doors!

For more information on new Spencer N-IV Ammonium Nitrate in polyethylene plastic or paper bags, mail coupon today!

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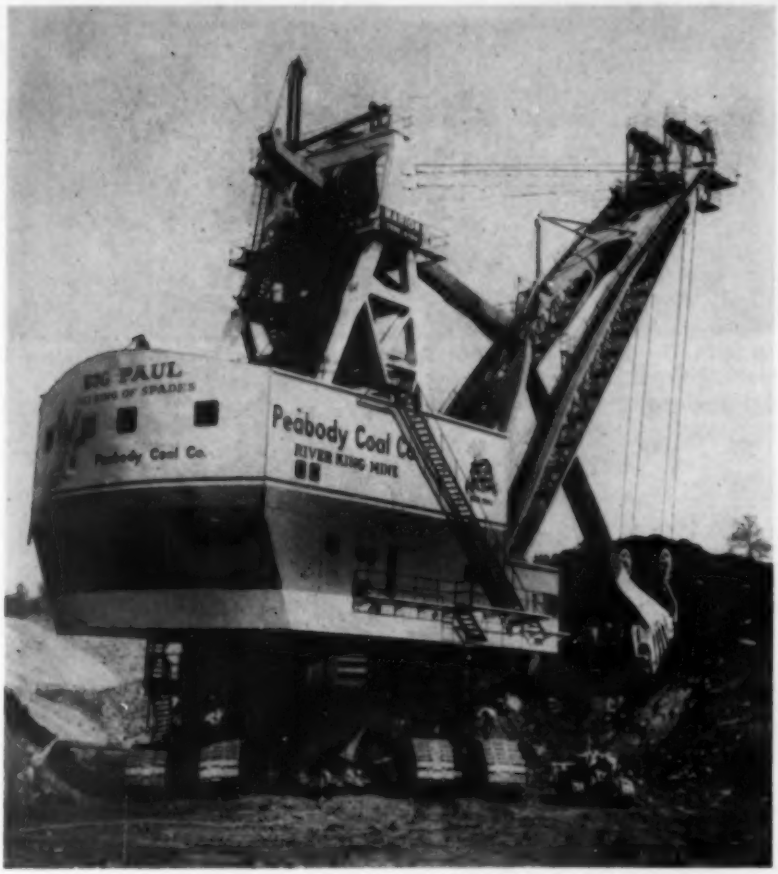


Careful advance planning to insure adequate room for spoil is a basic requirement in stripping with big shovels. Here is an account of how it's done at River King mine to keep "Big Paul" working at top efficiency.

YOU CAN'T AFFORD to get a machine like this in a landlocked position. The only way to prevent such an occurrence is make sure there is enough room in the spoil area for the material in the cut—before the shovel moves into the cut.

Strip-Mine Engineering For Big-Shovel Operations

By **W. A. Weimer**, Chief Engineer
Peabody Coal Co., St. Louis, Mo.

GOOD PIT DESIGN and informative operating maps are among the most important elements in working the River King pits, in my estimation as an engineer. Of course, the pit foreman thinks the planning of the various phases of recovery is most important, and the shovel operator gives precedence to the placement of spoil in getting through that hill ahead or past that slide. Each of these is vital in its own time. Therefore, we all do our work at the proper time to get the job done successfully.

We think our operating maps, prepared at a scale of 100-to-1, are most useful for our purposes. To secure data for the maps, prospect holes are drilled at the centers of each 2½ acres, or at 330-ft centers. Locations of these holes are fixed by instrument surveys, and surface elevations at the holes are recorded. Surface contours are determined by the rodman walking 5-ft contour intervals. All this information is placed on the tracing, in addition to coal contours which are interpolated by the draftsman.

We go a step further, to show overburden thickness in 10-ft intervals, and we employ a system of coloring these depth intervals on the white prints to aid our mine superintendents in their coal-recovery planning. The engineering detail on these maps has assisted our superintendents in working the River King pits, where the surface is rolling and rough.

Here is an example of how our maps will help in overcoming one problem, the successful contemplated

---

Mr. Weimer's description of big-shovel operations, on these pages, is adapted from part of his paper presented at the October, 1958, meeting of the Illinois Mining Institute at Springfield, Ill. For this article, Mr. Weimer has extended the operating data on the big shovel to the most recent date possible. A general description of River King mine operations, also a feature of the author's IMI paper, appears in the January, 1958, issue of *Coal Age*.

removal of a 100-ft-high hilly area.

Our 70-yd shovel has a 140-ft-long boom and is limited to a maximum digging depth of 66 ft of virgin bank. Many think that we acquired the big shovel primarily to permit us to strip deeper cover. This is true under certain conditions, but our main reason in getting the big unit is to permit faster, more efficient removal of cover of average thickness.

However, "Big Paul" recently had to tackle the 100-ft hill, previously mentioned. Fig. 1 shows the outline of the pit on Oct. 1, 1958, and the shovel cuts prior to this date. Note how the shovel cuts become narrower and "bend" around the hill as the deeper cover is encountered. The direction of these cuts was planned to permit widening of the pit in shallow cover and narrowing in thicker cover as the approach to the hill was made.

Narrowing the shovel cuts from 50 ft to 25 ft, which was done in the last several cuts, increases the shovel digging depth by approximately 3%. That much cross section is added to the spoil room by more completely filling the upper spoil section.

Now the shovel operator's skill comes into play in carrying the spoil back over the rear corner in approaching the hill. He will have the spoil well back when he reaches Point "A" on the map and profile in Fig. 1, where the maximum digging depth of the shovel, 66 ft, is reached. As he moves farther into the hill the spoil catches up with him. If he reaches the center of the hill with the spoil peak abreast of or in back of him, he can go through the hill. Otherwise, the shovel must turn back.

After several approaches and turnings he increases the sharpness of the outside curve of the spoil section around the hill, thus providing enough volume for him to stack the narrowed cut.

Referring to the profile below the map in Fig. 1, the horizontal dashed line represents the 66-ft limit on digging depth for the big shovel in straightaway cuts of normal width. At this depth, and under these operating conditions, spoil room is in bal-

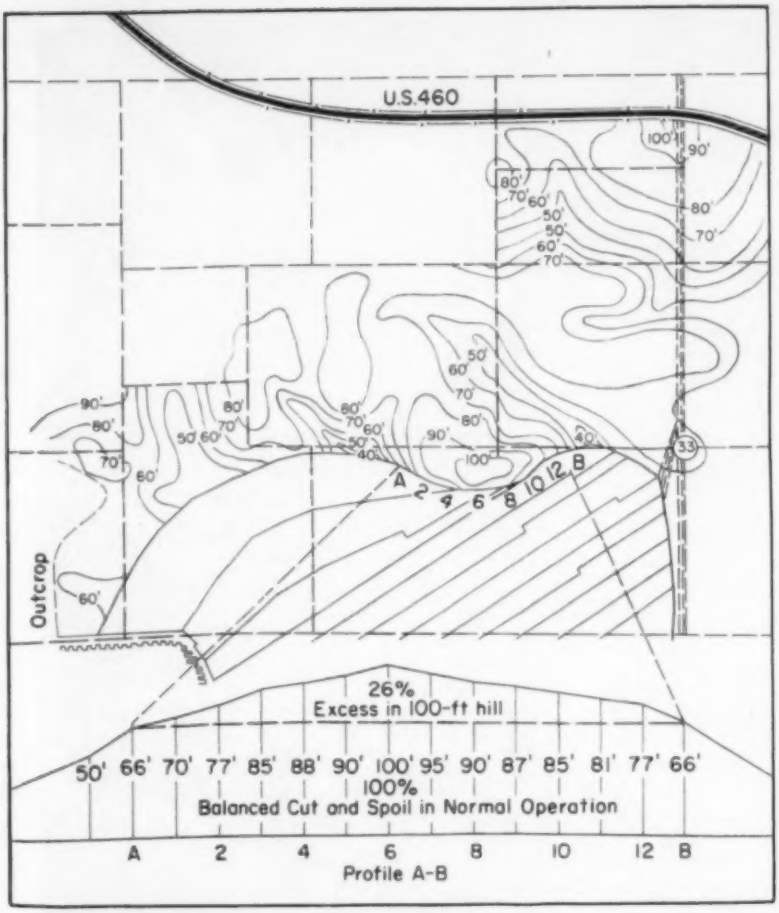


FIG. 1—THE PROFILE at bottom is prepared from contour map at top to show excess material in the cut beyond normal stripping range of shovel.

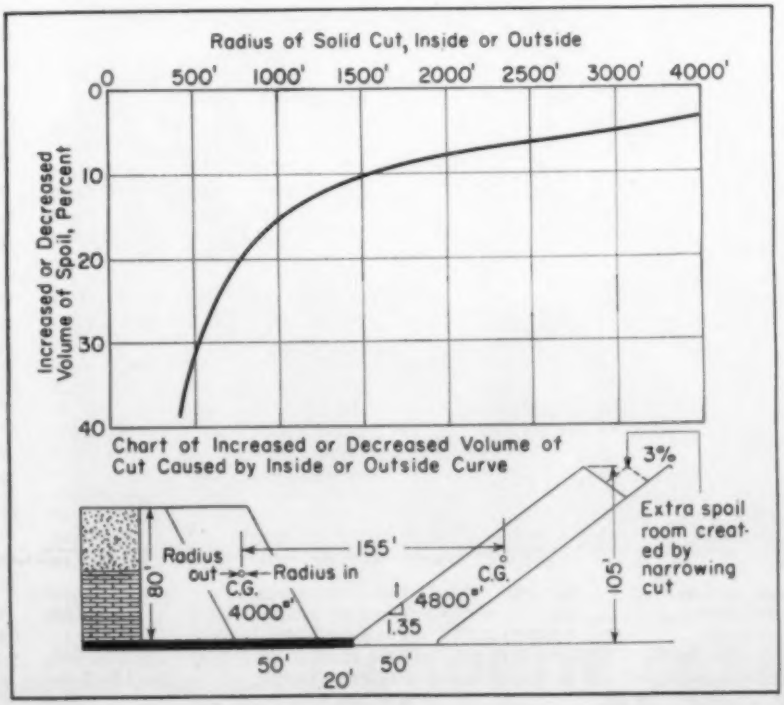
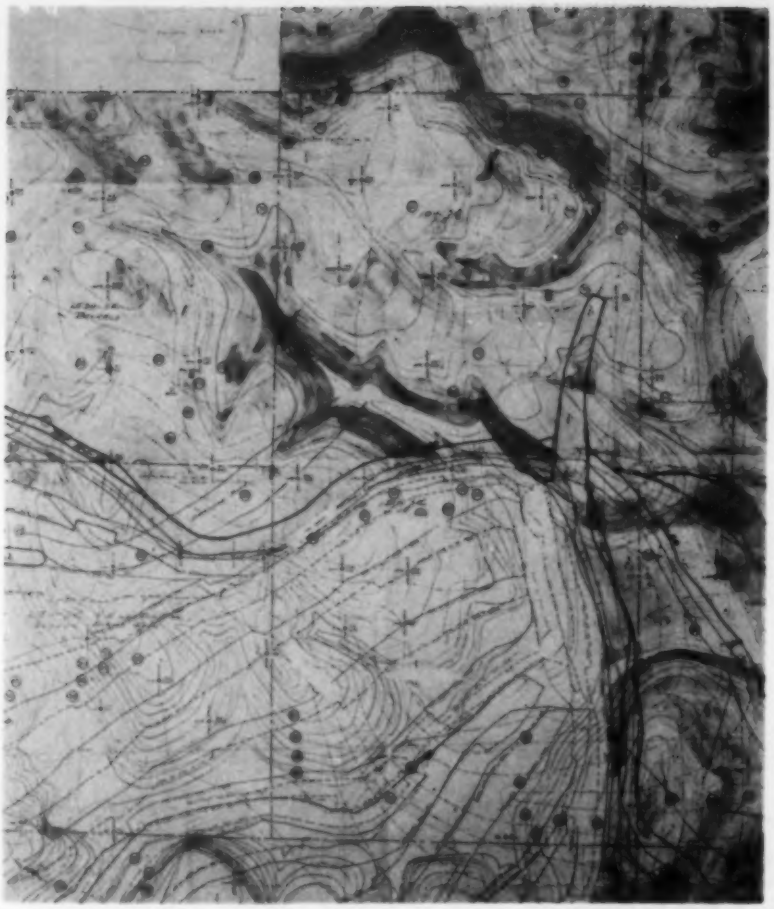


FIG. 2—REQUIRED RADIUS of outside curvature of solid highwall can be selected from graph at top to provide required increase in spoil volume. Narrower cut (bottom) also increases spoil volume.



RIVER KING'S 100 ft-to-1 in map provides mass of detail to guide shovel moves.

"Big Paul's" Performance at River King Mine

Month	Cubic Yards Moved	Cubic Yards Shot	Hours Worked	Hours Lost	Av. Yd, Per Hr	Acres Over Burden Removed	Bank Hgt, Ft	Ratio
July, 1957..	48,400	.....	131-45	59-15	367	0.60	50	
August.....	1,375,586	1,205,947	415-35	327-55	3310	17.33	49	11.56
September..	1,643,782	1,570,757	454-50	265-10	3614	14.76	69	15.18
October....	1,348,970	1,539,620	418-15	253-45	3225	12.84	65	10.88
November..	1,289,276	1,012,178	409-55	310-55	3146	12.95	62	10.54
December..	1,884,530	1,524,381	571-55	124-05	3295	17.79	66	14.25
1958								
January....	2,027,503	2,019,277	572-15	163-45	3543	19.07	66	11.32
February...	1,644,443	1,406,146	472-45	199-15	3478	14.22	72	11.58
March.....	1,158,042	658,062	345-20	374-40	3353	15.24	47	7.97
April.....	1,268,900	922,632	390-40	305-20	3248	14.30	55	10.39
May.....	1,721,123	1,436,031	527-40	200-20	3264	17.81	60	11.38
June.....	1,651,030	1,914,445	501-35	146-25	3292	15.44	66	10.86
July.....	1,427,012	1,430,000	456-00	260-00	3129	12.50	71	12.60
August.....	1,820,116	1,820,200	549-20	194-40	3313	20.11	56	9.55
September..	1,745,370	1,745,500	528-35	190-25	3302	18.92	57	10.54
October....	1,648,166	1,650,000	529-45	214-15	3111	17.54	58	11.51
November..	903,620	1,261,440	392-05	327-55	2305	7.66	73	13.38
December..	1,585,127	1,490,967	540-05	203-55	2935	15.95	62	13.95
Total....	26,190,996	24,607,583	8208-20	4122-00	3190	265.03	62	11.45

Operating time	12,330-20	Total cubic yards	26,190,996
Hours worked	8,208-20 (67%)	Yards per month	1,540,000
Hours delay	4,122-00 (33%)	Yards per hour	3,190
Electrical, 18%;		Bank shot	94%
Mechanical 53%;		KW-hours used	12,022,447
Miscellaneous, 29%.		KW-hours per yard	0.46

ance with the cut. The portion of the profile above this line represents the additional material in the 100-ft hill for which spoil room must be made. It amounts to a 26% increase in spoil-room requirements beyond the normal operating range of the shovel.

Now the trick is to provide room in the spoil area for this additional material. The graph of solid-cut curve radius v. volume of spoil room, shown in Fig. 2, was prepared by our engineering department to help us in these situations. The graph shows the percentage increases in spoil room that can be obtained at various radii of outside curvature of the highwall. Conversely, it shows percentage decreases in spoil room at various radii of inside curvature of the highwall.

The graph shows that a curve radius of 650 ft (outside curve) will provide an increase in spoil room of 24%. As previously explained, a gain of 3% resulted in narrowing the pit from 50 ft to 25 ft. Thus, a 27% increase in spoil room has been achieved where a 26% increase was needed. Realizing these gains now depends upon the employment of all tricks and maneuvers that the experience of pit superintendents and shovel operators can provide. The pit profile in Fig. 2 shows how added spoil is made available by narrowing the pit, in this instance to 20 ft.

This system serves well in working through deep hills in rolling terrain where the hill can be approached through shallower cover and the necessary maneuvers can be made to reduce the radius of outside curvature of the highwall to the desired value. We believe that proper shaping of the pits in advance and good planning based upon accurate maps are indispensable aids in situations like this.

The accompanying table shows the earth-moving performance and down-time records of "Big Paul," from the time the shovel went to work at River King mine in July, 1957, through December, 1958. This Marion 5760 is a compact, well-balanced and well-designed machine to handle such a large dipper efficiently. Men who are familiar with large stripping machines are not overly impressed by the physical size of the 5760 — it does not overwhelm the 5561 in bulk—but it handles so easily and digs, swings and hoists so quickly that the size of the machine becomes secondary to its performance.

Continuous production hangs on this shaft cable

Falling in unbroken, near-record drops of **one-third of a mile** each, two Okolite 5kv, strip-insulated shaft cables carry every bit of power down two separate shafts to Intermountain Chemical Company's vast trona mine in Westvaco, Wyoming . . . to operate diggers, loaders, conveyors, hoists, lights and blowers. Production, profits—and **lives**—depend on the absolute reliability of these cables.

"The cables are continually drenched by condensing moisture," says Jack Wilson, Intermountain's Maintenance Supervisor. Great length of the suspension puts tremendous vertical pressure on the cable components. Considering their importance as well as the tremendous job of replacing them, Intermountain naturally wanted the most reliable, longest-lived cable they could get. Those were two good reasons for choosing an Okolite-insulated construction.

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length: 1700 feet in each shaft

suspension: from a single clamp at shaft collar

construction: 3/c, 5kv, Okolite-insulated by strip process, with galvanized steel armor overall

weight: 19,000 lbs. each

tested: by 40,000 volts DC each

circuit and load: 4,160 volts from termination of Okolite-Okoprene aerial cables to power centers in mine

where there's electrical power . . . there's **OKONITE CABLE**

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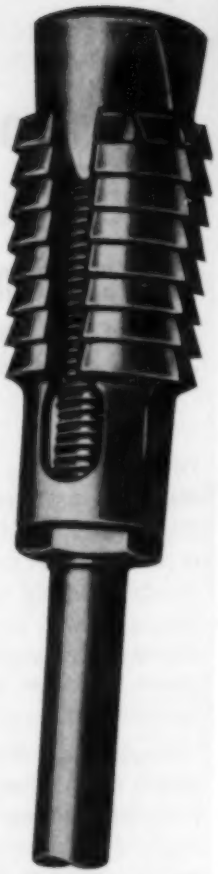
NEW!
Republic RS-1 Expansion Shell

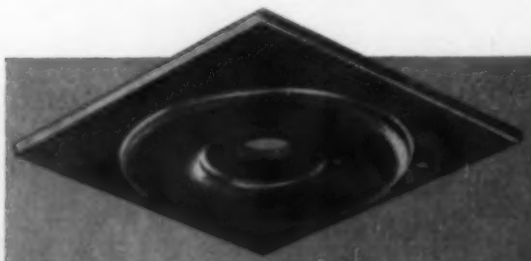
an all-purpose unit designed for effective use in any type strata



This new, improved, all-purpose Republic RS-1 Expansion Shell is designed with wide, sturdy leaves, and flaring inside taper for extra strength in relatively soft formations. The RS-1 anchor is particularly effective because the shell is held in position, before final tightening, by a new, Republic heavy-duty support nut. During the tightening process, the plug is drawn down into the flexible leaves, forcing them back into the rock in a wedge shape. Narrow base support for the leaves assures easy expansion during installation. The RS-1 is strong, flexible, and easily installed.

Republic offers the largest combination of roof bolts, roof plates, and expansion shell assemblies available to hold any type of mine roof or rock strata, safely and economically. Roof bolts of various types are now being used in hard rock metal mining, or in soft rock operations, such as gypsum and potash mining. They are also being used to provide support in tunnel work, miscellaneous foundation work, rock cuts, and similar projects.

Trained, experienced mine roof bolt engineers are always available for consultation at the mine. For more information on Republic's complete line of roof bolt assemblies, or for engineering assistance, contact your Republic representative, or mail the coupon.



Because of the embossed design, Republic's Do-Nut Roof Bolt Plate provides increased strength and greater area of pressure against the roof for maximum holding power, yet does not cause loss of headroom. Republic Roof Bolt Plates can be supplied in other types and sizes.

MATERIAL CONTROL CERTIFICATE FURNISHED BY REPUBLIC with every roof bolt shipment gives specific physical properties of the steel used. Guesswork and assumptions about performance are eliminated. Specific performance data for the heat, or heats, of steel used are indicated, including the mill order number, heat number, yield point in pounds per square inch, yield and break point in pounds for the size of the bolts.

MINE ROOF BOLT MATERIAL CONTROL CERTIFICATE

Republic Steel Corporation hereby certifies that the mine roof bolts included in mill order number _____ were made from the following steel:

HEAT NO.	YIELD POINT (PSI)	YIELD POINT (POUNDS)	BREAK POINT (POUNDS)

The above figures are correct as contained in the official records of the Corporation.

BY _____

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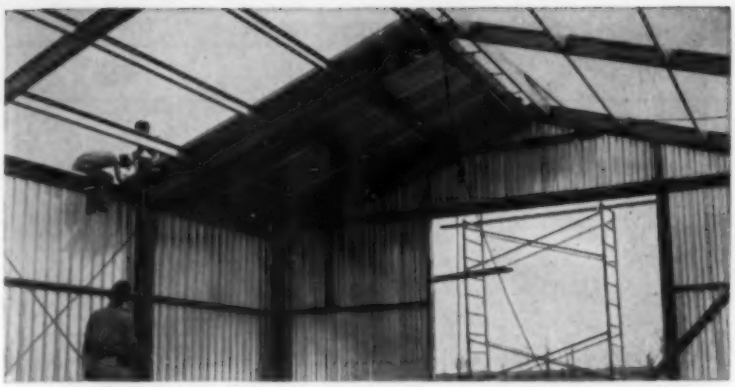
General Offices • Cleveland 1, Ohio



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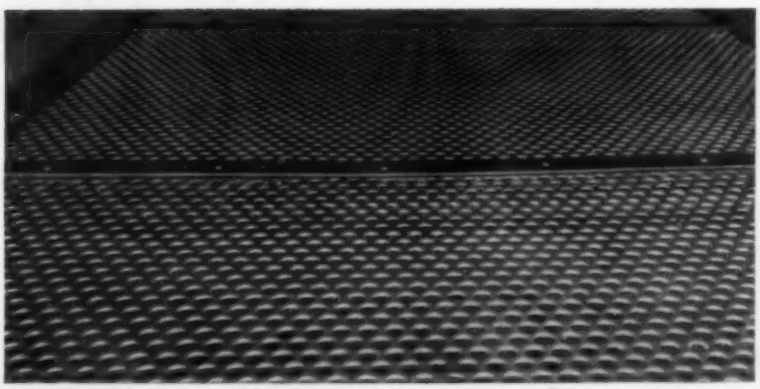

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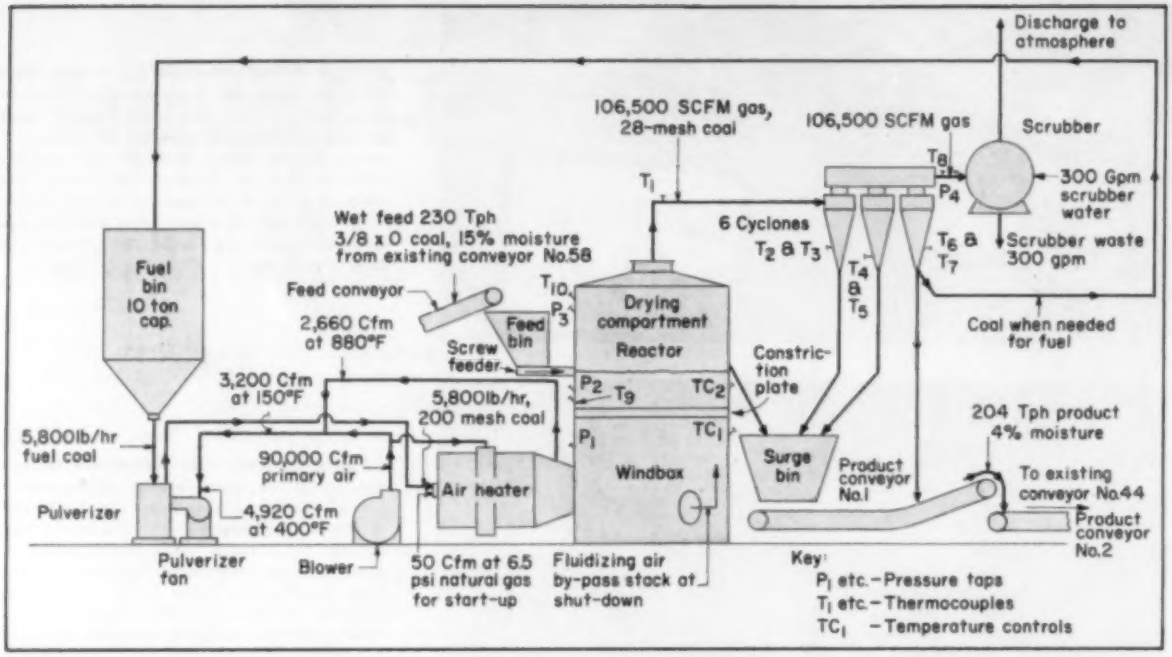
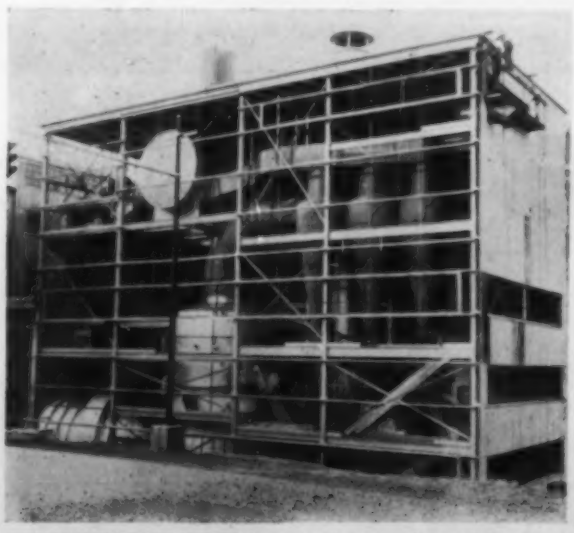


NEW DRIER has reactor compartment where coarse coal particles are kept in teeter by high velocity of drying air and fines are blown up to a battery of six cyclones. Coal flows across reactor without aid of conveyor.

Desliming and Heat Drying

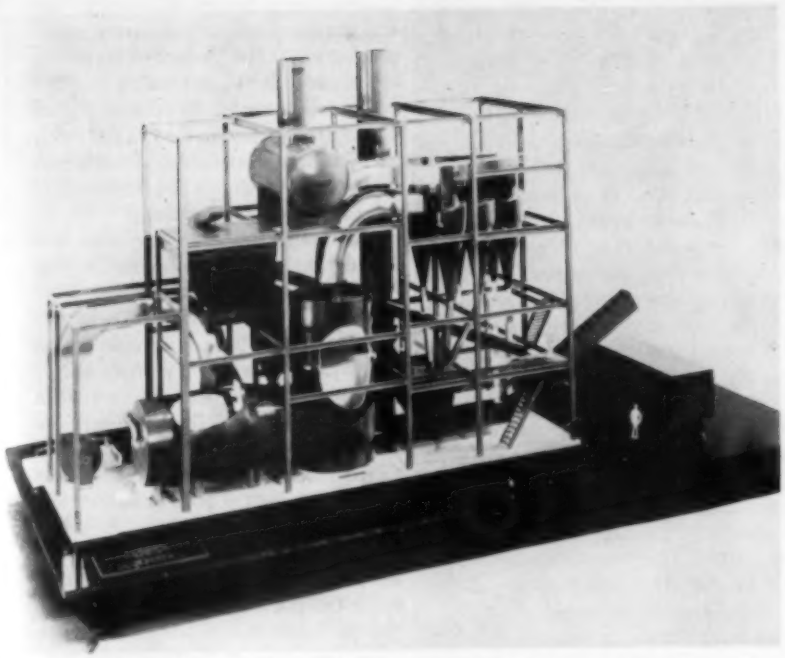
A coal preparation engineer analyzes desliming and heat drying, and reports on operating results with a new-type heat drier handling 5/8x0 coal.

By **R. M. Grimm**
Coal Preparation Engineer
Inland Steel Co.
Wheelwright, Ky.



CONSTRUCTION VIEW shows air heater at lower left, reactor in center and three of six cyclones at right.

EARLY STAGES of construction reveal foundation for heat drying plant and reactor component in position.



DRIER MODEL shows relative size and position of components. One water eliminator and three more stacks were added to final design.

DESLIMING is the intentional removal from coal of all particles smaller than 100-200 mesh. The reasons some coal operators are willing to waste these fine particles are that they are usually high in ash and moisture content. Also some of the coal values in this waste material may be recovered by Convertol and froth flotation procedures.

In Inland Steel Co.'s preparation plant at Price, Ky., these slimes will vary from 30-50% ash and 20-50% water, depending upon where the sample is taken.

There are numerous methods of desliming. The most common is by classification in water. Wet classifiers fall into two major groups. One group uses "hydraulic water," such as the hindered settling devices. The other is the "non-hydraulic" or sizing classifier. Two examples of the "hydraulic water" group are the Fahrenwald sizer and the Richards hindered settling classifier. This type of classifier functions by having water under pressure flowing up through a vessel containing a medium of solid particles and water. The fines normally overflow with water from the vessel and the coarser particles are removed as spigot products from the bottom of the vessel. Two examples of the "non-hydraulic" classifiers are the Dorr rake classifier and thickeners. In this type, the coal to be deslimed flows across the surface of the vessel. The coarser particles sink to the bottom of the vessel without the hindering effect of intentionally induced upward flowing water.

Another process of removing slime-causing particles from coal is the use of air instead of water. Even though this is not a new method of removing fine particles it is not generally practiced. Fine coal from the mine is often damp and tends to ball up. This grouping together of small pieces to form larger pieces hinders efficient operation in air separators. Again these "dedusters," as they are often termed, fall into two major categories. The first of these utilizes air currents with velocities which will carry away the finer particles from a stream of coal. Two examples of this group of dedusters are the "Orient Systems" and the Birtley dedusters. The second group includes those employing a centrifugal principle, similar to the air-cyclone.

This type is generally employed as a "dust collector," but its principle should be applicable to the separation of slime causing solids from a raw coal feed.

Adopted from a paper presented at the Kentucky Mining Institute, Nov. 7, 1958

Desliming Advantages

The removal of the minus 100-200 mesh material may be accomplished upon either the raw or clean coal, depending upon the method used, and should result in the following advantages:

1. Decreased solids load in circulating water resulting in:
   a. Improved efficiency of separation in some cleaning units.
   b. Less adherence of collodial clay particles from washery water to marketed coal.
   c. Aid in washery water classification.
2. Reduced load on dust collection facilities.
3. Possible reduced maintenance on pumps and pipes.
4. Decreased ash in clean coal resulting in:
   a. Simple ash reduction or,
   b. Increase of separating gravity permitting a higher coal recovery figure when obtaining the same ash content as with an unslimed coal.
   c. Possible increased capacities of certain washing units.
5. Decreased moisture content in mechanically dried clean coal resulting in:
   a. Simple moisture decrease or,
   b. Less evaporating capacity required for subsequent thermal drying.

With all the advantages enumerated it would appear foolish not to deslime. However, there are some disadvantages to consider. Some of these are:

1. Loss in recovery of clean coal. That is, desliming, unless followed up with some coal reclamation facilities, would result in the loss of whatever carbon values are found in an unslimed coal. In some cases this can amount to 2% or even more, of the total clean coal produced.
2. Increased capital investment required, not only to deslime, but also for subsequent treatment, handling and disposal of slimes.

Covering desliming in general, the problem is one of economics. If your ⅜x0 raw coal is of such a nature that the loss of the coal values, due to desliming can be offset by the increased recovery made possible by the lower ash of a deslimed coal, you and intentional desliming are in business. The words intentional desliming are used for a purpose. Every preparation plant using water as a washing medium has some sort of slime removal.

This partial desliming usually occurs with plant bleed water. If slimes were not removed, plant recirculated water would have to be squeezed out of a tube. If the solids in your plant bleed contain little recoverable and merchantable coal, and if you have an abundance of good make up water and no stream pollution problem, I doubt that planned desliming would prove to be economical. As I mentioned earlier, the problem of whether or not to deslime is one worthy of careful study. Usually each plant is a case by itself and no general rule may be applied.

The last major advantage of desliming was "Decreased moisture content in mechanically dried clean coal resulting in:

a. Simple moisture decrease or,

b. Less evaporating capacity for subsequent thermal drying. In plain words, less evaporating capacity means that a smaller drying plant would be able to dry your coal than one drying an unslimed clean coal. Also less fuel would be required to do the drying job."

Heat Drying

This leads into heat drying. Generally this is the process of evaporating by heated air the surface moisture retained on particles. The process is economic because one ton of our coal is capable theoretically of evaporating almost 10 tons of water. Among the many benefits of heat drying for Inland Steel Co. are:

1. Decreased unloading problem due to frozen cars of coal.

2. Increased bulk density in coke oven charges.

3. Less oil required for bulk density control.

4. Decreased transportation costs.

Heat driers rely on evaporation caused by heat exchange between hot dry air and the surface moisture on the coal. Therefore, heat driers differ in means of accomplishing this. Some driers work under a negative pressure, or suction, and draw exit gases through a fan. Other driers work under a positive pressure and all gases are purchased through the system. Another difference in principle between driers is the method of conveying the coal within the dryer. Some use mechanical means, others use gravity, high velocity air or various combinations. This paper has been billed as "Recent Developments in Coal Preparation." Our drier fills this bill as it is only the third such unit placed in operation.

The Fluo-Solids Drier

The plant was designed and constructed on a turnkey basis by The Dorr-Oliver Co. It is housed in a building about 90x35 ft and 60 ft high. The wet coal is brought into the plant by a 30-in belt conveyor which discharges coal into a 50-ton surge bin. Because of the "sticky" nature of this feed, the bin has a live capacity of only about 25 tons. The wet coal is conveyed into the drying vessel, or reactor, by twin Jeffrey screw feeders. The reactor is a vertical cylinder about 14 ft in diameter and 20 ft high. The wet coal feed falls toward a constriction plate located horizontally about 12 ft from the bottom of the reactor. This constriction plate is made of a series of T-shaped stainless steel bars about 1½ in across the top bar of the T. The bars are placed about ⅛ in apart to form a slot for hot-air distribution. Coarser particles of the wet feed are put into teeter, or fluo-solid condition, by the high velocity hot air. These particles are crowded and bounced from the feed point to a discharge gate. I should mention that this method of conveying is unusual, in that there are no mechanical parts in the hot air to convey the coal. The discharge gate is air operated and located opposite the feed point at constriction plate level. The coarser dried material falls into a sealed surge bin. The finer particles, roughly minus 28M, are blown up through the reactor into a common duct, which delivers the finer fraction to the top of six air cyclones. The reactors, ducts and cyclones are lined with either brick or gunite for insulation and abrasion resistance. The fines are thrown to the outside of the cyclone by centrifugal force, spiralled downward and discharged from bottom of the cyclones. These fines are dropped into the surge bin mentioned previously or into sealed scraper conveyors. The dusty air containing ultra fines is spiralled upward from the bottom of the cyclones and discharged from the top of the air cyclones. This dusty air travels under pressure, toward a Peabody gas scrubber. The scrubber is a horizontal stainless steel cylinder about 22 ft long by 11 ft in diameter. In the scrubber all exit gases pass through a pool of water, which is expanded or fluidized by air, and thence to three stationary water eliminators. The water eliminators contain angular blades which spin the exit air as it travels to exhaust stacks. This spinning motion throws the solids and water against a shield from which the water and solids are returned to the plant bleed water sump.

Other equipment in the drier is a fan, driven by a 1,000-hp motor. This fan supplies all of the air needed to dry and convey the coal. We have a Babcock and Wilcox pulverizer which pulverizes either reactor underflow or cyclone underflow for use as fuel in the dryer. The pulverized fuel is blown into an air heater, which is attached to the reactor. The air heater is about 20 ft long and 10 ft in diameter and is completely brick lined. A bustle pipe for admitting tempering air is located near the center of the heater. After the pulverized fuel is burned in the air heater, it is tempered by air from the main fan. All products of combustion and air from the main fan are blown into the reactor and up through the constriction plate.

Our drier has been in operation since December, 1957, and is being operated two shifts each day. We have one operator on each shift, who during operation, must remain in the control room. The operators are unable to grease and inspect, as they must constantly check and assist coal to flow from the pulverizer feed bin to the pulverizer feeder. The Dorr-Oliver Co. has developed a different feeding system which we hope will eliminate this. At present the manpower required, other than the operators, amount to one man hour per shift for greasing and inspection and about two man shifts per week for clean-up. I am unable to give you any reliable maintenance costs at this time. True maintenance figures would be too low to be representative at this time. On the other hand quite a few minor changes have been made. These charges, when included with maintenance, would make our figure disproportionately high.

Dryer Performance

The drier was designed to evaporate 25 tph of water. All conveying equipment was designed to handle 230 tph of wet ⅜x0 feed. At this time the drier is drying 175 tph of ⅜x0 coal from 14½% total moisture to 4-4½%. The feed is ⅜x0 clean coal

which has been dewatered by Bird centrifugal filters plus 15 tph of ⅝x3⁄8 clean coal. We are evaporating about 18 tph of water. To do this we burn about 2½ tph of pulverized fuel, using 88,000 cfm of air. The plant has a total of 1,250 connected hp.

Under normal operating conditions, temperatures in the combustion area (or the front) of the air heater, exceed 2,500 deg F. This hot air is tempered at the bustle pipe to 775 deg F for drying. The coarser particles are discharged from the gate at about 160 deg F, and contains 3¾% total moisture. The finer particles discharged from the cyclone are at 140 deg F and 5½% total moisture. Temperatures of the exit gas in ducts leading to the scrubber run 142 deg F dry bulb and 140 deg F wet bulb, indicating these gases to be very close to the saturation point. The dust loading in the gases discharged to atmosphere from the scrubber is 0.06 grain per cubic foot of air. We are using our plant bleed water, which contains about 13% solids by weight, to scrub or clean these exit gases.

Safety devices include: (1) The usual temperature indicators, which automatically turn on cooling water sprays, where high temperatures are indicated; (2) electrical interlocks to prevent overloading of the units and permitting a "safe failure," and (3) the inherent safety of the drier in that it does not overdry the fines.

Automatic controls with manual bypass arrangements are used throughout the plant. Three controls effect product moisture and act to give: (1) Constant depth of coal in the fluidized drying bed of the reactor (by discharge gate adjustment); (2) constant temperature in the drying bed of the reactor (by speed control of the screws delivering wet coal to the bed); and (3) constant wind box temperature (by varying the amount of pulverized fuel delivered to the air heater). These controls are very sensitive and quickly correct variations from set points.

In conclusion I can say that the Inland Steel Co. had experienced normal start-up difficulties. The Dorr-Oliver Co. is continuing to cooperate with us to find more satisfactory answers to some problems with attendant or accessory equipment. We must say that the Dorrco drier has demonstrated that it can do an efficient and closely controlled job with what appears to be a low maintenance cost.

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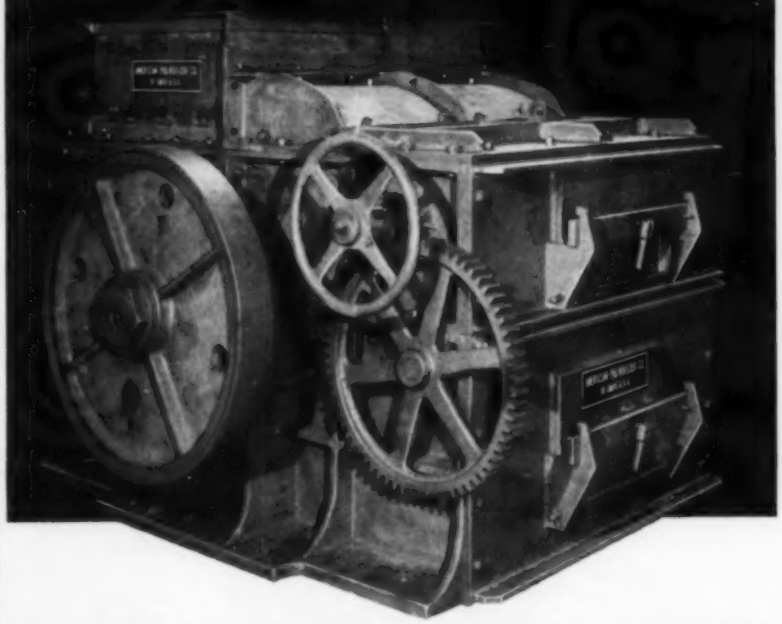

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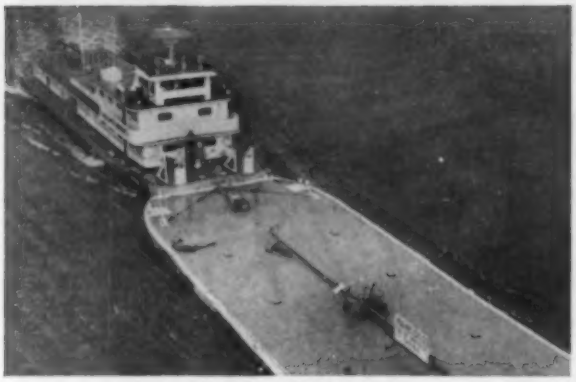

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Here's how the LO-380 Saves Tools—Cuts Repairs!

(1) Inlet reed valve meters air into the oil-resistant bellows

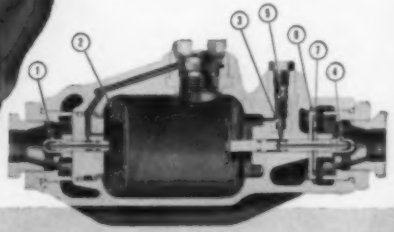
(2) which creates pressure that forces regulated amount of oil through porting connected to the needle valve (3) and the porting connecting it to the outlet reed valve

(4) through which oil is injected into the air stream.

(5) Set screw permits easy external adjustment of oil feed during operation.

(6) Positive pressure differential valve assures correct oil feed for all air flows — eliminates oil waste.

(7) Shut-off valve automatically stops air when oiler is empty. As oil supply goes down, bellows (2) expand and contact the shut-off plunger, depressing it until the valve reaches the automatic shut-off position.



That's right! *You'll never burn out an air tool with the new Le Roi LO-380 on the job!* When the oiler runs dry, it automatically shuts off the air! The "no oil — no air" design prevents unnecessary wear on critical parts — cuts repair bills — extends tool life!

The new line oiler assures positive lubrication for air tools — delivers a steady mist of oil at 10 to 150 psi — and keeps it flowing until you shut the air off, or until the empty oiler shuts it off automatically. Metered oil flow provides exceptional economy, prevents oil splurges. As a matter of fact, the LO-380 will pay for itself in a short time through oil savings alone!

Oiler permits easy external adjustment of oil feed — provides full one-pint capacity. Lightweight — only 9 lbs. — it's easy to use, easy to move—operates in any position. Oiler can be refilled under pressure while air tool is in operation.

Contact your nearest Le Roi distributor for details — or write to Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

LE ROI NEWMATIC® AIR TOOLS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

AT-906

Distributed in the Coal Fields by: Acme Machinery Company, Williamson, West Virginia, and Equipment Service Company, Inc., Birmingham, Alabama.

Foremen's Forum

Let's Find the Handles Again!

Are ominous unknown factors complicating the mission of achieving maximum mine safety?

Here are some thoughts on what might be happening and what might be done.

SAFETY PERFORMANCE in anthracite and bituminous shows steady improvement over the years, especially with regard to protecting the individual mine-worker from the hazards of roof and rib falls, haulage, electric shock and so on. However, a plague of recent disasters—Springhill, Bishop, Summersville, Pittston—makes us ponder the causes and possible preventives of such tragic occurrences.

Structural collapse, as at Springhill, fire and explosion, flood, and massive roof falls in other places are the evident causes of these catastrophes. But there are contributing causes which must be sought out and corrected. The mining industry will never ascribe an accident to "an Act of God," and let it go at that.

In the late Forties and early Fifties the industry achieved some remarkable long-term records of disaster-free operation. Now the big accidents occur at a frequency that is much too high. The reasons will be difficult to find, but the search must be made. Several avenues of approach come to mind which we ask you to think about now with us. They are as follows:

1. Does the weather have a greater effect than we realize in bringing about the unfavorable conditions which lead to ignitions and explosions?

2. Does the faster loading of strata, at today's mining pace, adversely affect the structural equilibrium of the strata?

3. Does the age of mines have any appreciable effect on their structural stability?

4. Are personal attitudes at fault?

Taking these one at a time, let's go a little deeper.

Weather and Methane

It has long been known that low barometric pressure is accompanied by an increased rate of methane emission, other factors being equal. It is also known that seasonal variations in weather conditions affect the moisture content of mine air, lowering the relative humidity in the colder seasons and raising it in the warm seasons. These are general truisms that scarcely scratch the surface as far as weather effects are concerned.

The fact is that the passage of a single cold front over the mine, which requires only a day or two, may have as much effect on mine moisture as longer seasonal changes in the weather. Furthermore, the passage of a cold front may produce a doubly adverse combination, a rise in atmospheric pressure and a drop in vapor pressure. These conditions exist during the day or two following the passage of the front.

C. B. McIntosh, associate professor of geography at Eastern Illinois State University, Charleston, Ill., has studied the weather conditions associated with 385 mine explosions, and he found some parallels that merit attention. An abstract of his studies appears in Foremen's Forum in *Coal Age*, February, 1958, p. 164.

More of this research might turn up valuable patterns for application in mining. Meteorological reports are indispensable to seamen and aviators. Are we certain they are not equally as important to underground workers?

Strata-Loading Rate

Creating and maintaining a state of equilibrium, either static or dynamic, is one of the major requisites in developing any engineering project. If this equilibrium is upset by extraneous forces for which no provision has been made, the project collapses, tilts, falls down, sinks or otherwise fails.

For example, if the force driving an airplane propeller is cut off, the plane no longer moves ahead with sufficient speed for the wings to generate the necessary lift. The equilibrium of the system is upset, so the aircraft falls.

Another example may be drawn from the military timber-trestle bridge, in which the allowable working stresses of the materials of construction are raised at the expense of a portion of the safety factor commonly employed in civilian design. Some compensation must be made for this encroachment on the safety factor.

The compensation is made by requiring that maximum-design loads be carried across a particular bridge in compliance with strict rules. A vehicle which represents a maximum load for a particular bridge, say a tank, should not be steered while it is on the bridge—it should be aimed along the centerline of the bridge prior to its entry onto the structure. The tank operator should not accelerate, decelerate or apply the brakes while on the bridge, he should take the load across at a slow, steady rate. Only one maximum-load vehicle at a time should be on the bridge, of course.

Violations of these rules might conceivably collapse the bridge under the tank, since acceleration, deceleration and slewing of such a maximum load in-

In close quarters . . .

O-B SHELLS AND PLUGS

they've proved easier to work with!

Where space—and time—is at a premium, the requirement is an expansion unit that "goes up easy and stays put!" Here flexibility is critically important—the ability to compensate for and overcome slight variations in the size and shape of the bolt hole. Here fast-setting expansion is a must—the ability to expand fast and hold fast in soft friable shale as well as hard rock. Here four-way expansion, low unit stresses, maximum *effective* use of the anchor's strength mean faster, safer, more efficient bolting—and here more and more operators are now specifying O-B expansion shells and plugs!

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EXPANSION SHELLS AND PLUGS • LINE MATERIALS • SAFETY AND CONTROL EQUIPMENT • ELECTRIC HAULAGE MATERIALS

troduce shocks in the structure. Designing-in-excess to handle these unpredictable shocks would be wasteful of time and materials, neither of which may be available in abundance.

This brings us back to the second question at the beginning of this piece: Does the faster loading of strata at today's mining pace adversely affect the structural equilibrium of the strata? Perhaps not in uniform seams under cover of uniform thickness, but it may have an effect where thickness of cover varies widely. The fact of the matter is that much of our knowledge of roof action is empirical. If places are driven too wide, with respect to the time they must be kept open, the roof falls or is kept in place only at great expense. If places are driven too narrow, production suffers. Balancing these important considerations into a happy medium has been more or less based upon long experience. In view of the changed nature of modern mining, our most pressing problem may be the determination of new parameters to pin down the variables in roof action. It's a process of finding new handles upon which to lay hold. Admittedly it will not be easy.

The Age Factor

Is an old mine more susceptible to disturbances in strata equilibrium? Let's look at this one.

All rock crumbles in the process of weathering. Alternate wetting and drying, freezing and thawing are the simple but potent processes by which mountains are leveled. When the mountains are honeycombed by man-made openings presumably the processes increase in tempo. In some degree this action in older mines may be a contributing factor in the occurrence of bumps. We don't know, but perhaps it could be so.

We are tempted to think of the possibility of stabilizing these strata in new mines destined for long life as the openings are developed. We are reminded of widely used soil-stabilization processes which now are employed to convert soils having very little natural structural stability into suitable beds for heavy-duty highways and runways. The trick is to use a minimum of portland cement and just the right amount of water to fill the voids between particles of soil in a compacted mass without causing expansion of the mass. This condition is described as one of "optimum moisture and maximum density." The result is a useful stabilization at low cost of otherwise useless native materials.

Only one step farther and we come to the possibility of stabilizing strata through the use of injection processes, a development that is not unkown to us today. We may be on the threshold of a remarkable breakthrough here. Continuing research may provide low-cost agents and reasonable techniques which will permit the creation and maintenance of a state of equilibrium in strata. In fact, it may someday be possible to introduce the stabilizing agents in the normal ground water and to adjust the setting time of these agents to achieve the best possible sealing and stabilizing action. This is the merest hint of a cloudy suggestion. Again, we don't know what the possibilities really are. But 15 yr ago only a few realized that roof-bolting was a distinct possibility and coming fast.

People and Safety

Personal attitudes have changed for the better. In the past there were conflicts, even in safety matters, between governmental agencies and between management and labor. The conflict has given way to reasonable discussion, sometimes heated but at least cooperative. Management is vitally interested in safety. It is the only sane way to do business. Labor has formally organized to promote safety actively. Supervisors are conscientious in demanding compliance with safety regulations. They suffer if they drag their feet. The various government agencies actively conduct research, primarily to enhance safety, and we believe most inspectors are able and sincere in performing their appointed duties. Anyone familiar with the business can sense this atmosphere.

Still the accidents happen.

Increased emphasis on top-notch engineering may provide the answer. This will require an increased investment in engineering by all interested parties. Basic and applied research must be pursued. More informative exploration and mapping may have to be done. Much will depend upon the professional excellence and personal dedication of the engineer himself.

The challenge is big, as pointed out by Robert Louis Stevenson when he described an engineer, as follows:

"He is always the practical man. The rains, the winds and the waves, the complexity and fitfulness of nature, are always before him. He has to deal with the unpredictable, with those forces that are subject to no calculation; and still he must predict, still calculate them, at his peril. His work is not yet in being, and he must foresee its influence; how it shall deflect the tide, exaggerate the waves, dam back the rainwater, or attract the thunderbolt . . . he must not only consider that which is, but that which may be."

We think a new assault on coal-mining hazards requires these attitudes.

Finally, the suggestion of Joseph T. Kennedy, secretary, Pa. Dept. of Mines and Mineral Industries, that mining laws be reviewed in the light of modern mining practices, is a good one for all states.

Wrapping it up, it can be said that in the improvement of safety

- Luck is not a factor,
- The problem will not go away,
- So let's find the handles on this situation again, take hold of them and continue to steer toward the goal of accident-free coal mining.

10 Hints on Accepting Changes

Technical developments within the industry are tumbling over each other. Here are ten hints to help you make the most of these changes:

1. Don't scoff at new ideas. If you must reject an idea, do it only after sound evaluation.

2. If changes are "just too much trouble," your days in this business are numbered.

3. Accept new types of machines with enthusiasm, and make an honest effort to get the best out of the newest.

4. Become convinced of the worth of an idea yourself before you try to sell it to the men in your crew.

5. Be ready to change your opinions of new ideas and equipment in the light of new or refined facts.

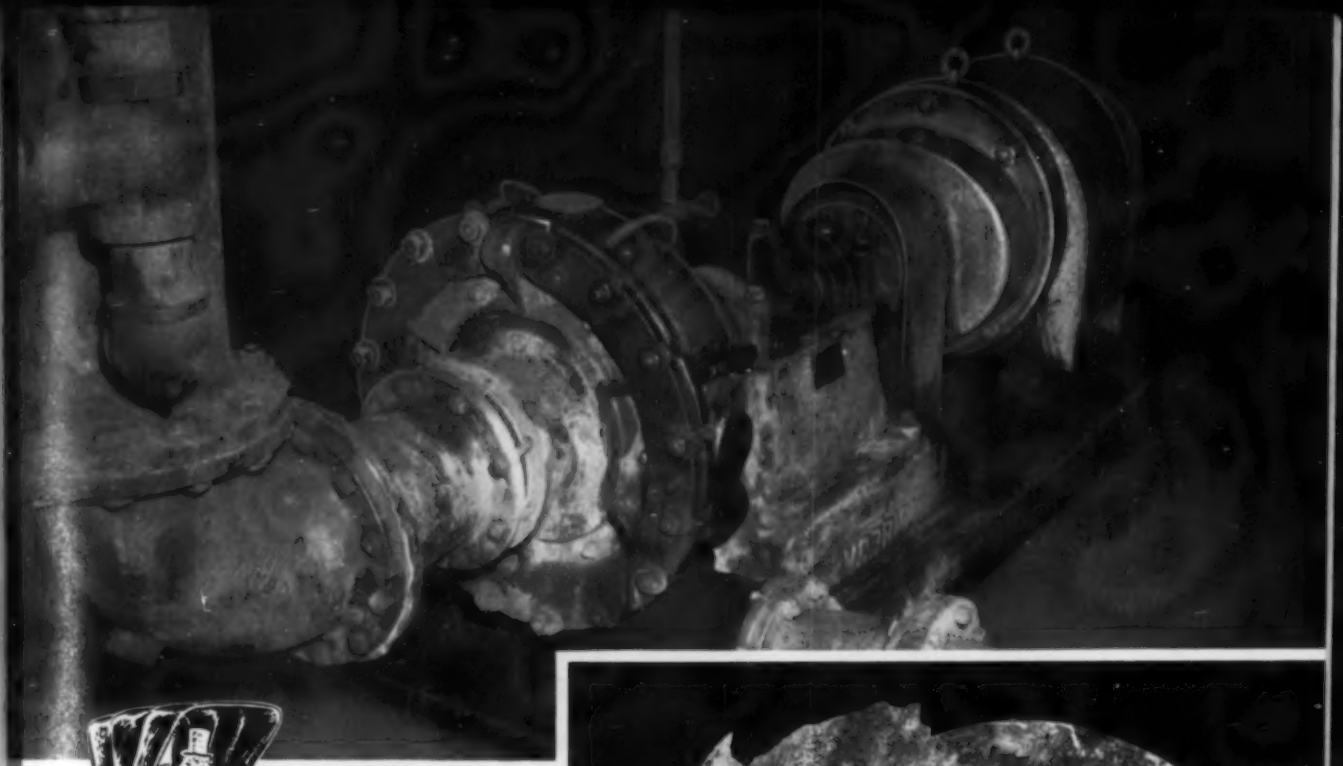
6. A new man should be a welcome challenge to a supervisor. You can train him to your standards.

7. Don't wish for the "good old days." These are better days—the safety records prove that.

8. Try to devise schemes for doing mining jobs better than they have been done before.

9. Carefully criticize an idea in your own mind before you flatly support its adoption.

10. Take an interest in industry forecasts. The progessive foreman wants to know what's ahead.



Modern "One-Hoss Shay"

Remember "The Wonderful One-Hoss Shay"? It ran for 100 years, each part wearing so evenly with the others that all disintegrated at the same instant!

Uniformity of wearing qualities is a key characteristic of Morris Pumps. Witness the worn-out impeller from a Morris Type K pump at right. The vanes are uniformly worn to less than ½" thickness. The suction shroud is completely gone, except for a paper-thin portion little larger than a hand.

Yet the retention of original vane contour maintained hydraulic performance at normal levels, so that only a routine overhaul revealed the extent of overall wear.

Durability and dependability over the long pull are the *normal achievements* of Morris Pumps. They are the result of proper design backed by superior materials, careful engineering, and fine workmanship.

• Why not call on our engineers for qualified recommendations of pumps you can depend on for years of uninterrupted service.

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ONLY WESTINGHOUSE CONSTRUCTION SUITABLE FOR WORLD'S LARGEST SEALED DRY-TYPE MINE POWER CENTER

MINE power center specifications are extremely exacting . . . so exacting that only Westinghouse, the leader in the field, offered a construction found suitable for the world's largest sealed, portable mine power center.

Only Westinghouse construction could combine—in a unit with the desired 600-kva, 7200/480-volt rating—the necessary ruggedness, compact low height and light weight essential to easy portability within mine tunnels.

Here are the key features in this construction:

External ruggedness—A ¼-in. steel plate case protects against roof falls, rough use. A ⅝-in. base plate with ½-in. reinforcing skid runners protects the unit when skidded over rough bottom, haulage tracks, etc., during frequent relocation.

Internal ruggedness—Core and coils braced at both top and bottom to withstand full short circuit conditions, securely mounted in case to withstand moving and rough handling.

Low height—The most compact mine power centers made, the 600-kva unit is only 42 inches high, the 300-kva unit only 36 inches.

Low maintenance cost—Nitrogen-filled, sealed, dry-type power center is practically maintenance-free; protected against moisture even when de-energized during prolonged shutdowns.

This sealed mine power center is but one of the complete line of Westinghouse power centers available to serve the mining industry above the surface, as well as below. Ask your Westinghouse representative about the power center to serve your specific applications.

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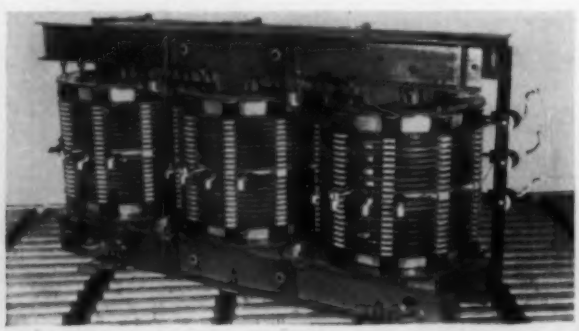
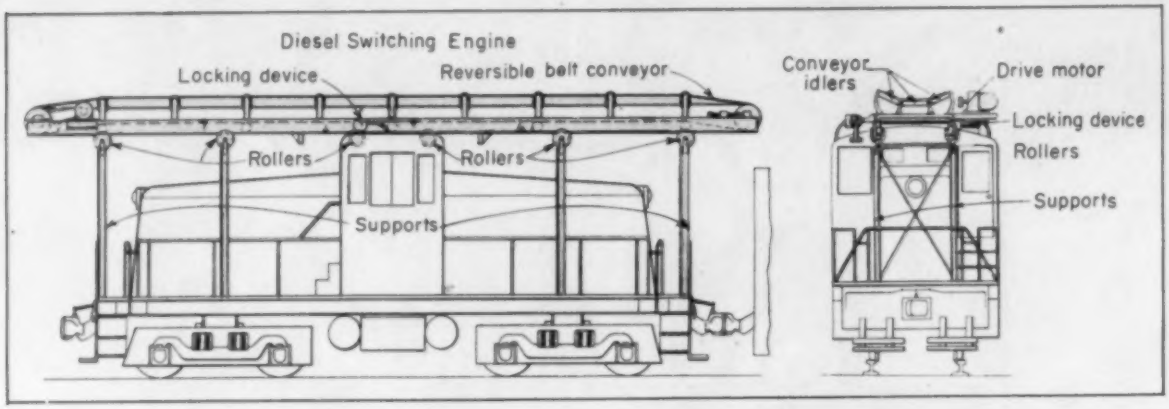
Convenient location of the high-voltage receptacle on world's largest sealed mine power center permits hitching to low-voltage end when unit is skidded to a new location. This allows unit to remain energized; high-voltage cable can pull straight without bending, and buggy can obtain its motive power from one of the secondary feeders.

A full range of ratings in ventilated mine power centers is available from Westinghouse for application where conditions are less severe—such as less dust, lower humidity.

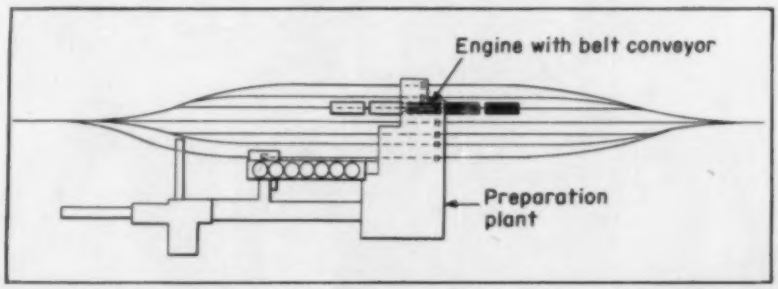
Core and coil assembly for 600-kva, 7200/480-volt, 3-phase unit—world's largest sealed mine power center made by Westinghouse.



Operating Ideas



Switch Engine-Conveyor Provides Continuous Car Loading

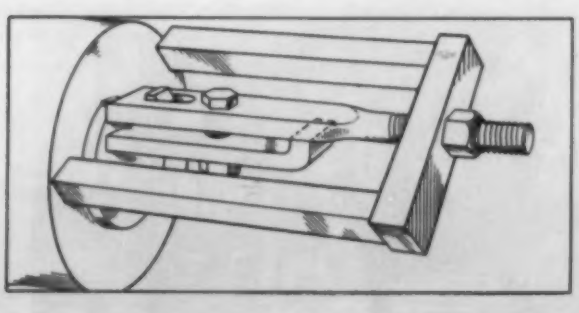


CONTINUOUS car loading and elimination of the hazardous operation of riding empties down from the empty hill and loads away from the preparation plant are two major benefits of a loading conveyor and car loading system recently patented by Ralph R. Richart, former member of the *Coal Age* editorial staff and now electrical engineer for the Freeman Coal Mining Corp., Waltonville, Ill. The system employs a diesel switching engine on which is mounted a troughed-type reversible belt conveyor that extends a short distance beyond the couplers. This combination of equipment, called a Loco-Veyor, makes possible grouped railroad car exchanges under the loading chute without interrupting the flow of coal to the cars.

The Loco-Veyor and its crew, in constant touch through radio with the tipple loading point and the scalehouse weighman, can move the coal cars through the tipple area effectively and with greater safety to the workmen, Mr. Richart notes. Continuous loading can take place on several tracks simultaneously and a supply of empty cars can be switched to any given loading chute and the loads switched out without interrupting the loading operation.

The reversible belt conveyor operates continuously when under the loading chute to move coal dropped on it to one end for loading into a new empty being pulled under the loading chute. After a new string is positioned under the chute, the switcher may be disconnected from them and used to move the loaded cars to a storage track. While a string of empty cars is being loaded, the Loco-Veyor may be employed in arranging additional groups of cars on one or more tracks.

The belt conveyor rests on carrying rollers which are mounted on rigid vertical support braces. Additional rollers also are mounted on the upper surface of the locomotive cab. The conveyor frame may be moved 2 ft forward or backward on the rollers to provide clearance so the Loco-Veyor can be coupled to a box car if desired.

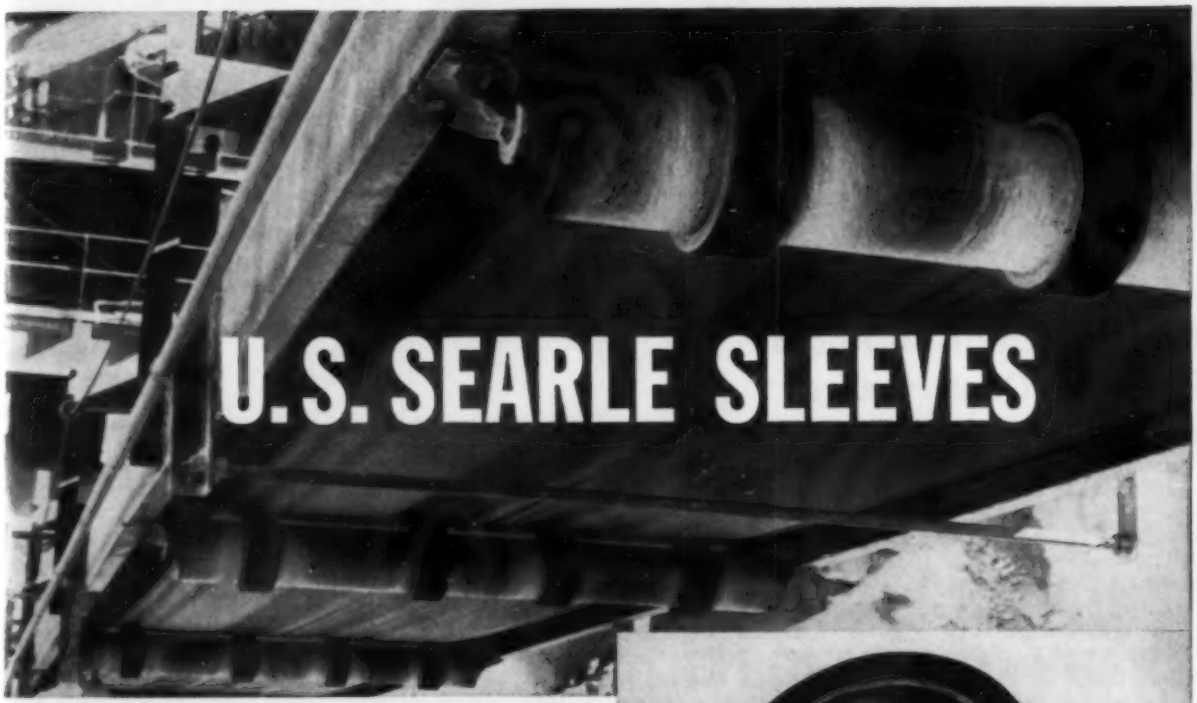


Shop-Made Key Puller Is Rugged

HERE is a rugged key puller that can be quickly and easily made, writes Charles H. Willey, Penacook, N. H. It can be made from material already on hand in most shops. Its size depends on the type of job you want to do and the size of the key. Components of the puller include a bolt, clamp, forged yokepiece with threads, back and space bars.

SEARLE SLEEVES

The patented proven way to prolong conveyor belt life!



The patented Searle Sleeves are made of abrasion-resistant cushion rubber reinforced by heavy belt duck. Installation is fast, just slip them over the idler rolls. At impact points, cementing is recommended.

The build-up of wet muck in coal mining and fines and dust in metal mining are minimized or completely prevented on belts when idlers are equipped with U.S. Searle Sleeves. These Sleeves protect idler rolls from impact damage at transfer points. Keeping idlers clean and free from build-up eliminates constant servicing, and at the same time insures longer belt life. Belt "wandering" is eliminated and edgewear greatly reduced on both belt and idlers.

• • •

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

Close-up of U. S. Searle Sleeve. Available in large variety of sizes to fit conventional conveyor idlers.

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MOBILE UNIT with swivelling nozzle applies calcium-chloride paste.

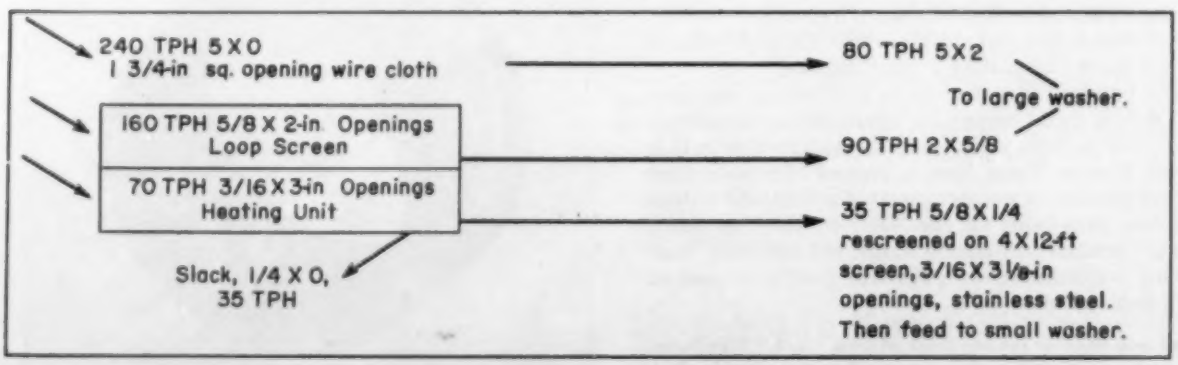
Calcium-Chloride Paste Reduces Dust Hazard

A NEW PROCESS developed by the Chemische Fabrik Kalk, of Koeln, Germany, is said to appreciably reduce the risk of underground explosions and fires. The experimental mine operated at Dortmund-Derne by the state government of North-Rhine Westfalia has lately been conducting experiments with a calcium-chloride process developed by Dr. Buggisch of the Kalk works. Plant engineers at the experimental mine treated a 400-ft stretch of roadway with calcium-chloride paste after which more than 4 tons of finely pulverized bituminous coal was blown into the roadway. Measurements taken a short time later showed that 40% of the coal dust had settled on and was bound by the paste. A month later a further 3½ tons of finely pulverized coal were blown into the test stretch. Further tests immediately prior to a controlled explosion showed that the paste now contained about 40% combustible material.

A controlled explosion was initiated and the flame penetrated into a 70-ft stretch of roadway in which finely pulverized coal was concentrated at the rate of about 1 lb of dust per cubic yard. The fine dust swirled up by the initial explosion carried the flame only 150 ft into the 400-ft section of treated roadways. Flame speed was 512 fps.

An inspection carried out immediately after the explosion revealed that the layer of paste had been little damaged by the force of the blast. Prior to a second blast being initiated, a further 1½ tons of pulverized coal were blown into the workings, and a more powerful explosion charge was fired. Readings taken between two points located 160 ft apart in the section gave a flame speed of about 1,600 fps. The dust-impregnated paste in those sections of the roadway immediately in the path of the explosion was ripped off in large lumps. The whole section was filled with a wet, clinging fog caused by heavy evaporation of the water contained in the mixture of coal dust and calcium chloride.

The Kalk company has also constructed mobile machinery with a swivelling spray nozzle for applying the ready-mixed paste to the walls, supports, props, etc. of the underground workings, and other equipment for storing and transporting the paste. In addition to appreciably reducing the fire and explosive hazards, some experts predict that the calcium-chloride paste method will play a leading role in reducing pneumoconiosis by binding airborne dust and keeping settled dust moist.


240 TPH 5 X 0
1 3/4-in sq. opening wire cloth
160 TPH 5/8 X 2-in Openings
Loop Screen
70 TPH 3/16 X 3-in Openings
Heating Unit
Slack, 1/4 X 0,
35 TPH
80 TPH 5X2
To large washer.
90 TPH 2 X 5/8
35 TPH 5/8 X 1/4
rescreened on 4 X 12-ft
screen, 3/16 X 3 1/8-in
openings, stainless steel.
Then feed to small washer.

Screen Conversion Eliminates Blinding

SCREEN BLINDING has been eliminated by means of a screen conversion at the Florence mine of the Harmon Creek Coal Corp. near Burgettstown, Pa. The problem was solved by converting a 6x12-ft double-deck Ripl-Flo screen into a triple-deck unit with the bottom deck equipped with a Thermo-Deck heating unit.

Before the changeover at the Harmon Creek preparation plant, the minus ¼-in coal was removed on a separate 4x12-ft screen which was unable to handle the load without blinding and excessive carryover of fines into the washer. The new arrangement works without blinding in practically all weather even with up to 6% moisture in the coal.

PERMASEAL® Idlers – installed for 42", 48" and 60" belts at 10,000 ton per day coal handling facility on Ohio River.

NEW-TYPE CONVEYOR IDLERS STRETCH GREASING INTERVALS TO YEARS

Grease 'em by-the-month idlers are expensive to maintain. The Jeffrey PERMASEAL® Idlers in this coal handling system won't need greasing for a year—maybe several years. Their slightly higher initial cost (due to superior bearing protection) is quickly absorbed by unparalleled low cost of maintenance.

Bearing failure is the major cause of idler failure. The PERMASEAL® Idler's unique double seal design protects bearings as they have never been protected before. On coal handling systems and dirty, abrasive handling jobs, Jeffrey PERMASEAL® Idlers are proving their ability to outlast any other idler on the market.

Get more data on PERMASEAL® Idlers. Your materials handling supervisor should have all the facts on PERMASEAL® Idlers. Contact a Jeffrey distributor, or write The Jeffrey Manufacturing Company, 912 North Fourth Street, Columbus 16, Ohio.

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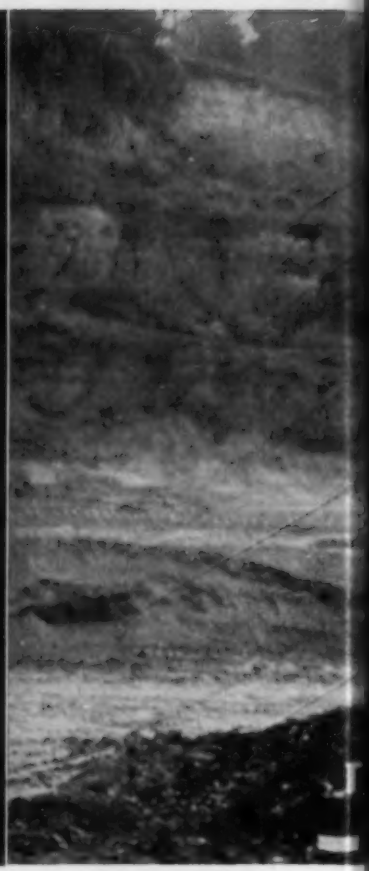
Chevy power is tough—

and proves it on bruising off-the-road hauls!



That Series 100 Chevy tandem above takes a terrific pounding as it hauls huge loads of gravel or fill dirt into the heart of California's redwood country. It goes miles off the road, makes up to 24 trips a day through rocky forest land. Yet owner Bernard Conti, of the Conti Sand & Gravel Company, reports only one hour of downtime in 20,000 miles on this truck-killing road construction job. And Chevy's tough power gets the truck through faster, Mr. Conti says; assures more trips—more profits—per day!

Hauling outsized loads of fill dirt through California's forests calls for a heavy-duty truck that's rock-rugged and powerful as they come; one that's soundly built down to the last bolt. And the Conti Sand & Gravel Company bears witness to the fact that Chevrolet is just such a truck. They're completely satisfied with their Series 100 model, from the dependable pulling power of the big 230-h.p. Workmaster V8 to the work-whipping qualities of the tough-built chassis components. And you'll be equally satisfied with whichever Chevy heavyweight or middleweight *your* work requires!

Mr. Conti indicates that Chevrolet's Powermatic* transmission is of special importance in this rugged service. It helps him to bull through the tough spots with exceptional ease. This fully automatic 6-speed transmission virtually eliminates manual gearshifting! It also provides a Hydraulic Retarder that helps you control truck speed and saves wear on the service brakes.

**Optional at extra cost, Series 50, 60, 70, 80, 90 and 100 models.*

No job's too tough for a

Chevy's powered to cut costs and keep going on your tough off-the-road hauls!

That's for *sure*, whether you use mighty middleweights or high-capacity heavyweights—whether you prefer V8's or 6's.

Take Chevrolet's 1959 big-truck V8's, for example. As indicated by that tough truck job pictured above, these modern engines are out to whip any work that comes their way. They've got what it takes to do it. The *shortest piston stroke* of any comparable truck V8's: a sure sign of more work on less fuel. Compact design that cuts down on truck weight and helps assure the biggest possible payloads. Scores of up-to-the-minute features that know how to trim overhead: full-flow oil filter, hydraulic valve lifters, hard-faced exhaust valves and hardened valve seats, extreme-duty Moraine 400 bearings, rotor-controlled governor, overspeed warning light and many more.

And with a *complete* lineup of modern V8 powerplants —including 160-h.p. Trademaster, 160-h.p. HD Taskmaster, 175-h.p. HD Super Taskmaster, 185-h.p. Workmaster Special and 230-h.p. Workmaster—Chevy can match the engine to your work, ideally.

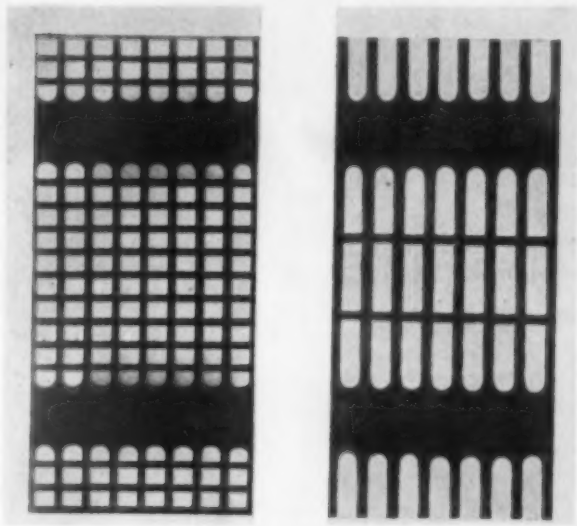
Or if you prefer 6's, Chevy's *still* your best bet. Standard in Series 40 models is the 135-h.p. Thriftmaster 6, better than ever for '59 with a new Economy-Contoured camshaft that improves gas economy by 10%! And in Series 60 there's a new edition of the 150-h.p. Jobmaster 6. It offers new durability stemming from new tougher built pistons and Stellite-faced exhaust valves. Both of these famous 6's provide plenty of hard-pulling torque.

Six or V8, you'll go a long way before you see the likes of this '59 Chevy engine lineup. Actually, there's only one *best place* to go for all your trucking needs —and that's to your Chevrolet dealer's. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

Chevrolet truck!

CHEVROLET

Equipment Developments



Long-Wearing Screens

For accurate sizing, rubber and rubber-thread screens held by metal panels which attach to any vibrating machine are being introduced by Pyramid Screen Co., New York, N. Y. Widely used in Europe, especially for screening coke or coke breeze, the devices are highlighted by a long working life, and are available in square- or oblong-hole types. Construction consists of perforated rubber strips fixed by steel anchors beneath the screening surface. As the rubber strips are highly tensioned by their metal-panel framework, accurate sizing is assured.

The frame of the rubber-hole screen deck serves also as a tentering frame, permitting installation on any screening machine. Other construction features aimed at long wear are these: frame and anchors are either hotdip galvanized or coated with special varnish, and bedding of the steel anchors on the filling bars of treated ash-wood strengthens the rubber-hole screen vibration. Elastic yielding of the screen holes prevents blinding or clogging of the screen and the conical shape of the apertures permits clean passing of the material to be screened. Information on the variety of hole dimensions available may be obtained by writing to Pyramid Screen.

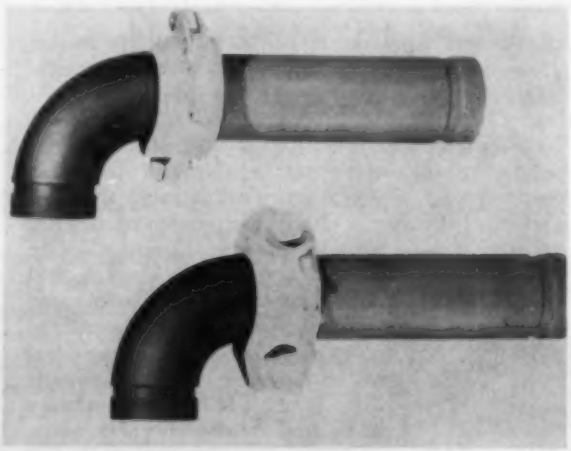
Bigger Motor Grader

No. 14 motor grader, rated at 150 hp and weighing more than 29,000 lb, stands as the largest, most powerful motor grader ever manufactured by Caterpillar Tractor Co., Peoria, Ill. Designed for high productivity, the new machine uses 10-in rims for 14.00 x 24 tires providing a wide rim base, thus straightening side walls and reducing side rolling. Of the machine's 29,050 lb weight, 22,000 lb rest on the drive wheels resulting in good traction and full utilization of its large size and power. A turbo-charged engine with an 18% torque rise powers this Series B grader which incorporates numerous other features, according to the firm. The transmission provides six forward and two reverse speeds. Forward travel speeds range from 2.6 mph in first gear to 21.6 mph in sixth.

Package-Type Filter

For dewatering coal and other fine-flotation concentrates, a package-type American disc filter has been announced by Dorr-Oliver, Inc., Stamford, Conn. Retaining the design advantages of the standard American disc filter, this new package dewaterer features fabricated pipe center shaft and easily changed disc sectors, which are covered with 60-mesh stainless-steel wire-mesh filter media. One principal design modification is a special receiver developed to allow mounting of the filtrate pump in line with the filter. The receiver vacuum and filtrate pumps, motors and controls are arranged on a skid platform according to individual installation requirements.

The company states that the machine provides a relatively small, high capacity dewaterer that can be installed more easily than conventional filtration stations. The unit is supplied with all necessary piping and wiring and may be placed in operation as soon as connecting piping and electrical connections between filter and auxiliary package are completed. Packaged units are available in either 4- or 6-ft diameters with either 4 or 6 discs to provide filtration areas ranging from 86 to 300 sq ft. Operating on a 28-mesh coal feed containing 30% solids at a rate of 50 lb per sq ft per hr, the units will deliver a 75% solid cake at capacities ranging from 4,300 to 15,000 lb per hour.



Simple Plastic Fittings

Piping systems made entirely of plastic are easily assembled with new plastic mechanical couplings which expand and contract with the pipe. These fitting made by Victaulic Co. of America, Elizabeth, N. J., are molded in sizes from 1¼ to 8 in in three materials: regular polyethylene, special high-tem-

How's this for special trackwork?

Here, crowded into a space only 42 ft 6 in. long, is a nifty little gem of special trackwork. Its components include two diamond turnouts, four No. 2½ turnouts and a single-rail crossing. Bethlehem's Johnstown, Pa., plant fabricated it, using 20-lb ASCE rail for 26-in. track gage.

Bethlehem is ideally set up to handle complex track designs like this, and will welcome your inquiry. We can furnish everything from a complete mine haulage system down to a simple turnout. And of course we make the switch stands, guard rails, heel blocks, tie plates and other accessories of modern track. Just contact the nearest Bethlehem office. Or write direct to the address below.

BETHLEHEM STEEL COMPANY, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

perature linear-type polyethylene, and polypropylene. Elbows, tees, crosses, 45-deg laterals, reducers, caps and flanged adapter nipples for joining to bolted flange systems are also available in all three materials. Smooth in internal texture to minimize friction, the plastic fittings are light and resilient, capable of taking tough on-the-job abuse, declares the firm. Disassembly is as easy as assembly, permitting quick changes in plastic-piping layouts if required, according to Victaulic. Additional benefits cited are economy in use and resistance to deterioration through age, rot or chemical action.

New Ripper Chains

Three continuous-miner ripper chains with better bit-holding qualities have been announced by Joy Mfg. Co., Pittsburgh 22, Pa. These chains, declares Joy, will improve ripper-type miner performance and prolong bit life. Two of the new models have an expanded differently-shaped shank hole to accommodate modern reinforced-shank carbide bits. All of the new chains use an improved set screw that holds the bit better than cup-point set screws, according to the firm.

The GV-6111 ripper chain is an optional improved model of the standard Joy G-6111 used in the past 4 yr on ripper-type miners. It has both the larger, round shank hole and the new set screw.

Type LV-6111 has a similar bit-holder design, but offers a shorter pitch length of 6⅜ in compared to GV-6111's 7½.

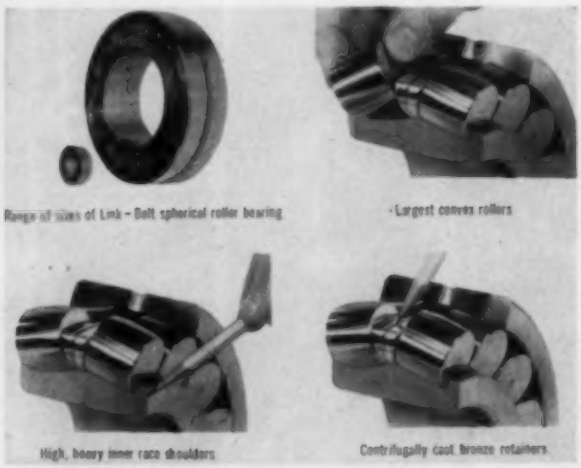
Type L-6111 is the production design of Joy's L-6110 chain which has been undergoing field tests for 2 yr. It is similar to the standard G-6111 but uses shorter 6⅜-in pitch length.

Portable Silicon Rectifiers

Recently developed by Westinghouse Electric Corp., Pittsburgh, are new 500-kw 300-V DC portable silicon rectifiers for mining application. They are rated full load continuously, 150% full load for 2 hrs and 200% full load for 1 min. The rectifier equipment consists of two mine cars 42 in high. One car contains the silicon rectifiers, switchgear and associated protective devices and the other car includes the transformer. With the exception of the motor-driven fan used to cool the silicon cells, all equipment is static. Therefore, maintenance is minimized, says the firm. Because of the inherent low loss of the silicon cells, the efficiency of the unit is 97%, adds Westinghouse.

Better Explosive Bags

Bemis Bros. Bag Co., St. Louis 2, has developed a new explosives bag for packaging industrial explosives. Sometimes used with a shock-absorbing bag, it is made of a three-ply Flexiply (multi-ply creped kraft paper) outer tube and a specially-extruded pinhole-free seamless polyethylene liner. The poly liner, identied by a longitudinal red stripe running the length of the film, can be safely heat-sealed through the outer Fexiply to provide a perfect waterproof closure, states the firm. The new bags have been submerged in wet holes as long as 7 days without a leakage and are especially recommended where moisture in varying degrees creates a problem in blasting operations. In addition to heat-sealability and waterproofness, the bag is resistant to oil used in the ammonium nitrate-fuel oil mixture and stands up against the impact of dropping into bore holes.


Range of sizes of Link-Belt spherical roller bearing
Largest convex rollers
High, heavy inner race shoulders
Centrifugally cast bronze retainers

Improved Roller Bearings

Link-Belt Co., Chicago, announces a combination of three major improvements resulting in spherical roller bearings wit unusually high capacity:

1. Each bearing contains the highest possible number of the largest-diameter convex rollers, giving the bearings their highest possible capacity.

2. Centrifugally-cast bronze retainers assure smooth quiet bearing performance even under extreme speeds and loads.

3. Higher heavier inner race shoulders make it possible to assemble or remove bearings easily from shafts with conventional shop equipment.

Other features are, according to the firm: troublefree operation at high speeds; low operating temperatures; low noise level; and center-groove lubricat'on. The new bearings are being introduced in Series 22200 and 22300, in bore sizes ranging from 1.5748 to 11.0236 in with dynamic load ratings up to 288,000 lb. They will also come in pillow blocks in bore sizes from 1 7/16 to 10 in.

Continued on p 126

B.F.Goodrich

B.F.Goodrich Rock Service tires give coal company 30,000 miles before retreading

UTILITY COAL COMPANY operates a strip mine near Marion, Illinois. 25,000 tons of coal a month are hauled from pit to tipple over rough roads pocked with holes and large rocks. For this rugged work, Utility chooses B.F.Goodrich Rock Service tires—and no wonder. One set went 30,000 miles before retreading, has gone 8,000 miles since and has thousands of miles yet to go. Rock Service tires have minimized road delays, given maximum traction.

The Rock Service tire has a double chevron tread that grips the road in forward or reverse. The tread is specially compounded to resist rock cuts and bruises. And under the tread is the B.F.Goodrich FLEX-RITE NYLON cord body that withstands double the impact of ordinary cord materials, resists heat blowouts and flex breaks. This is why the B.F.Goodrich FLEX-RITE NYLON cord body outwears even the extra-thick Rock Service tread, can still be retreaded.

If you want better tire service at lowest cost per mile, see the money-saving tires your B.F.Goodrich Smileage dealer has for every type of mining job. Look for your B.F.Goodrich dealer's address under Tires in the Yellow Pages of your phone book. *B.F.Goodrich Tire Co., A Division of The B.F.Goodrich Co., Akron 18, Ohio.*

Enter the B.F.Goodrich Truck Tire Mileage Contest. You can win a Thunderbird or Corvette or one of 310 other prizes. See your B.F.Goodrich dealer for entry blanks.

Smileage!

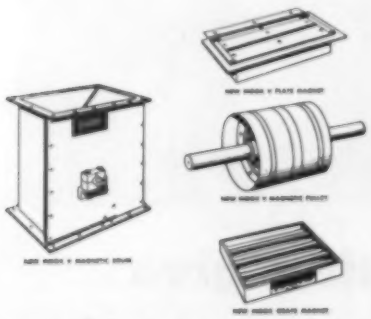
Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment

B.F.Goodrich *truck tires*

© B.F. Goodrich Company

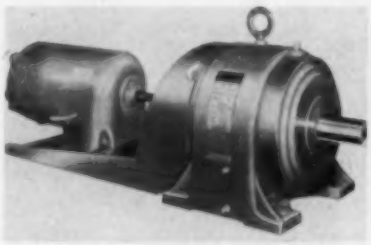
Equipment Developments (Continued)

SWING BOLT PIPE COUPLING—The coupling is made of malleable iron and is manufactured by Charles E. Manning Co., Pittsburgh 36, Pa. It features a positive, safe locking device that can't snap open and is said to cut installation time and labor 25% when applying couplings to grooved-end pipe. One man can apply the gasket, put the housing in position, swing the bolt closed and tighten the single nut easily and quickly. The swing bolt, rated up to 500 lb, comes in 1-, 2-, 3-, and 4-in sizes.

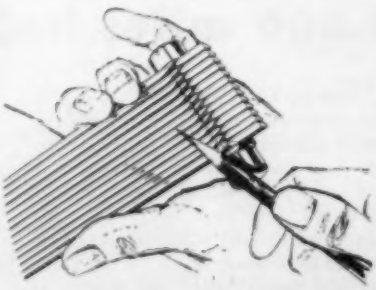


TRAMP-IRON SEPARATORS — These devices, from Stearns Magnetic Products, Milwaukee 46, are highlighted by use of Indox ceramic permanent magnets. The ceramic material is barium ferrite pressed into a compact and permanently magnetized, producing a flux pattern for effective tramp-iron separation. Some basic applications, Stearns notes, include: Indox V magnetic pulley installed at the head of a belt-conveyor system, resulting in better performance than conventional permanent-magnet pulleys; Indox grate magnet, installed in hopper or floor opening, chute or duct to guard product and plant against tramp iron. Stearns reports no dead spots, resulting in 400% greater area than with ordinary grate magnets.

VERTICAL MOTOR—A new re-rated vertical motor, designed for easier installation and maintenance in industrial pumping applications, is now available from General Electric, Schenectady 5, N. Y. Addition of this totally-enclosed, fan-cooled explosion-proof motor gives GE a complete line of vertical motors in the new NEMA re-rated frame sizes. Featured for easier maintenance are: an oversized oil filler hole, a large drain plug, an easy access conduit box, an oil level sight gage and a lightweight top cap. The motor runs through the 445 UP frame size. The firm's full line now has ratings from 7 1/2 to 125 hp at 1,800 rpm.



GEAR REDUCER—A combined gear reducer and gearshaft drive unit providing 4 or 8 speeds on the output shaft of the gear reducer is a new product of The Lima Electric Motor Co., Inc., Lima, Ohio. The new line includes double and triple gear-reduction units with capacities from 1 to 10 hp. Four possible positions of the shift lever on the gearshift drive permit four different output speeds on the gear reducers, and by using a two-speed motor it is possible to obtain eight different speeds. Standard electrical characteristics are: constant torque, 3 or 2 phase, 60 cycles, 208, 220/440 or 550 V. Special voltages and frequencies along with mechanical modifications are available.



PREPARATION SCREEN — This "tapered slot" preparation screen, designed to eliminate binding when screening large amounts of "near opening" size materials, is a new product of Wedge-Wire Corp., Wellington, Ohio. Basic Wedge Wire construction consists of a series of wedge-shaped wires looped at regular intervals around a cross-rod positioned at right angles to the wires. Typical distance between loops is 2 3/4 in. In the "Taper Slot," the opening between the wires gradually increases in width between loops, enabling materials that would normally lodge between the wires to be transported, with the flow of the mass, to the larger end of the tapered slot. At this point the material either passes through the screen or breaks loose and continues on with the material flow.

NEW-TYPE TRACTOR—Shifting "on-the-go" without using a clutch is featured in a newly announced tractor from Ford Motor Co.'s Tractor & Implement Div., Birmingham, Mich. Providing 10 forward and 2 reverse speeds, the machine is gear-driven at all times and is termed a great advance in tractor operating convenience by Ford. A small hand-controlled "Select-O-Speed" lever just below the steering wheel permits shifting gears merely by "dialing" the desired gear ratio. Precise movement is possible with an inching control pedal located where the foot clutch normally is found, and the operator can pre-select any of five gears (3, 5, 7, R1 and R2) and set stops for the ones desired in shuttle operations.

NO GREASING—From Allis-Chalmers Mfg. Co.'s Tractor Group, Milwaukee 1, comes the announcement that greasing is no longer necessary on "Positive Seal" truck wheels, front idlers and support rollers for their entire crawler line. This is an added operating advantage making possible complete elimination of greasing the tractor undercarriage, regardless of mud, water or other adverse

Maneuvering into or out of narrow, twisting underground tunnels is easy for LeTourneau-Westinghouse Rear-Dumps. Model D can U-turn in less than 25'. If roof clearance is 14'8" or more, "D" can raise bowl and turn in a tight 18'8" of clearance.

Fast, clean dump by 11-yd D Tournapull Rear-Dump speeds rock to crusher at Fort Hartford Stone Co., near Hartford, Ky. Electric motors, standard on all Tournapull units, raise and lower bowl with speed and safety.

"Only units maneuverable enough to give us good production"

That's how Mr. A. C. Hall, owner of Fort Hartford Stone Co., Hartford, Kentucky, describes the 4 LeTourneau-Westinghouse D Tournapull® Rear-Dumps that move up to 225,000 tons of limestone a year from deep inside the firm's underground mine.

Three of the 11-ton-capacity L-W units are usually assigned to haul excavated rock from shovels working in the tunnels. They complete 6,000′ round trips . . . one third of that distance inside the narrow tunnels . . . in an average of 12 minutes. Of this operation, Hall says: "Large trucks just can't turn in the working area. 'D's' are the only machines that can maneuver in the tight quarters of the working faces without stopping. It cuts lost time."

Double-duty yard workers

Another "D" normally works in the open, stockpiling rock and gravel, and pushing rail-cars. At times, the whole L-W Rear-Dump force teams up with 2 front-end loaders to fill rail-cars in the yard. Rear-Dumps carry the material from crusher to stockpiles near the cars. Tractors then load it aboard. This "teamwork" loads a car in an average of only 12 minutes elapsed time.

Six years of tire use

"D" maintenance is easy. Hall cites tire-life as an example. "Our first Rear-Dump was new when we bought it," he said, "and it was six years before we had to replace a tire.

"Whenever I've decided to buy another hauler, I've considered all makes carefully. And I've always decided on a Tournapull Rear-Dump."

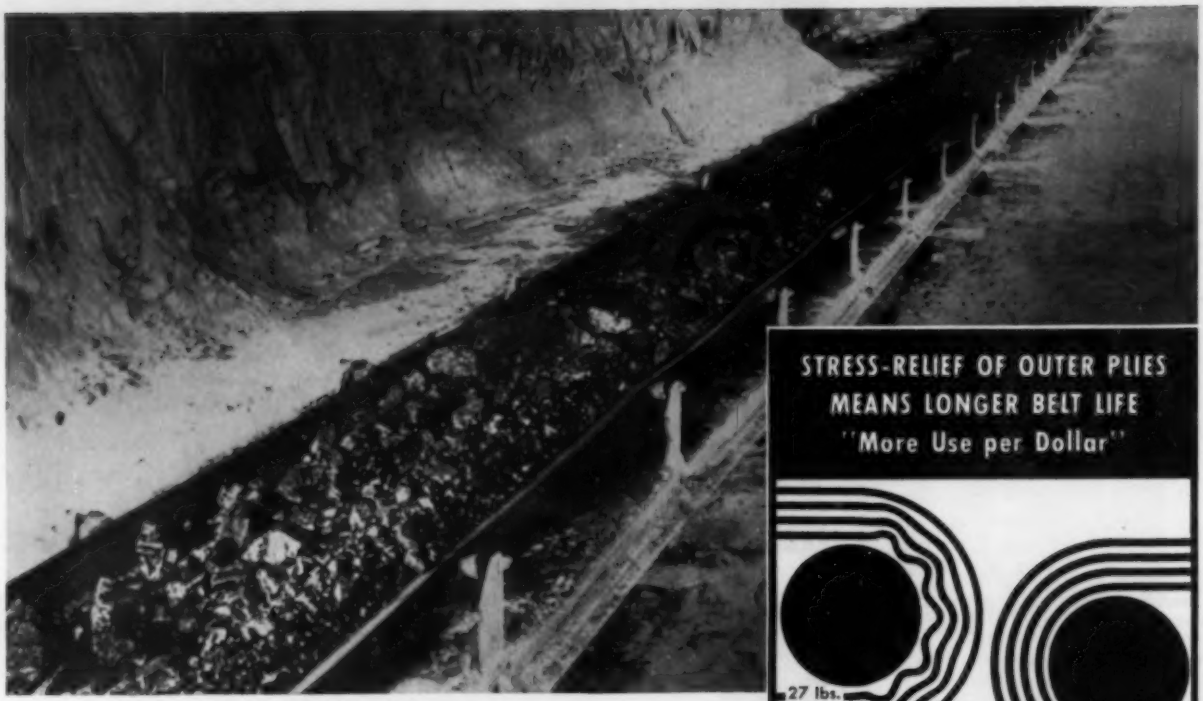
LeTourneau-Westinghouse Rear-Dumps are available in three sizes: the 138-hp, 11-ton "D"; 226-hp, 22-ton "C"; and 335-hp, 35-ton "B". Ask for a demonstration of the model best suited to your work.

DE-2006-MQJ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



RIP RESISTANT
RAY-MAN CONVEYOR BELT
HAULS *MORE* COAL... LASTS *LONGER!*

Ray-Man Conveyor Belt trains *naturally*, troughs *easily* . . . handles *more* coal even where small pulleys are required in low head-room operations. Special cushioned strength members, and Double-Compensation to relieve outer-ply stress, provide needed impact resistance *plus* exceptional flexibility. Ray-Man is highly rip resistant . . . requires *no* breaker-strip and holds fasteners better than any other belt construction. Exclusive "XDC" Cover adds additional protection against wear, tear, cuts and abrasion never before possible!

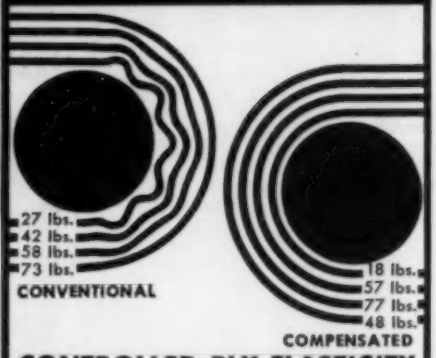
Like all Manhattan underground belts, Ray-Man is mildew-proof, moisture resistant—and available with Bureau of Mines' acceptance designation: "Fire-Resistant, U.S.B.M. No. 28-10." Ray-Man does a *better* job, *longer* . . . and it's *safer* to use!

Let an R/M representative show you special advantages of other R/M conveyor belts . . . Homocord for unusually severe shock loading, R/M Tension-Master for extra long lifts, high tensions. There's an R/M heavy duty belt to give "More Use per Dollar" on every handling job.

R/M POLY-V® DRIVE—Patented new concept "trouble-proofs" your mine drives. Delivers up to 50% more power in same space as ordinary V-belt drives . . . or equal power in less space! Single V-ribbed belt eliminates "matching" problems . . . minimizes belt and sheave inventories. Write for Poly-V® Drive Bulletin M141 today.

**Poly-V is a registered Raybestos-Manhattan trademark.*

STRESS-RELIEF OF OUTER PLIES MEANS LONGER BELT LIFE
"More Use per Dollar"



CONTROLLED PLY ELASTICITY

Note how Double-Compensation at right equalizes ply stresses.

1. Center plies on neutral axis and better protected carry more load.
2. Outer plies stress-relieved by adjusting to tension and compression.

INDUSTRY'S *ONLY* COMPENSATED BELT

Ray-Man Compensation relieves outer ply stress . . . allows outside ply to elongate more than inner plies as the belt flexes around the pulleys. Inner plies no longer "loaf", but carry full share of the load.

Outer ply is better able to absorb strain and impact of loading, pull as a strength member, *protect* the inner plies, hold fasteners or splice longer.

And, because Ray-Man is *double Compensated*—both top and bottom plies stress-relieved—Ray-Man Compensation prolongs belt life, even where operated over reverse bend, snub or take-up pulleys!

RMB13

BELTS • HOSE • ROLL COVERINGS • TANK LININGS • INDUSTRIAL RUBBER SPECIALTIES

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

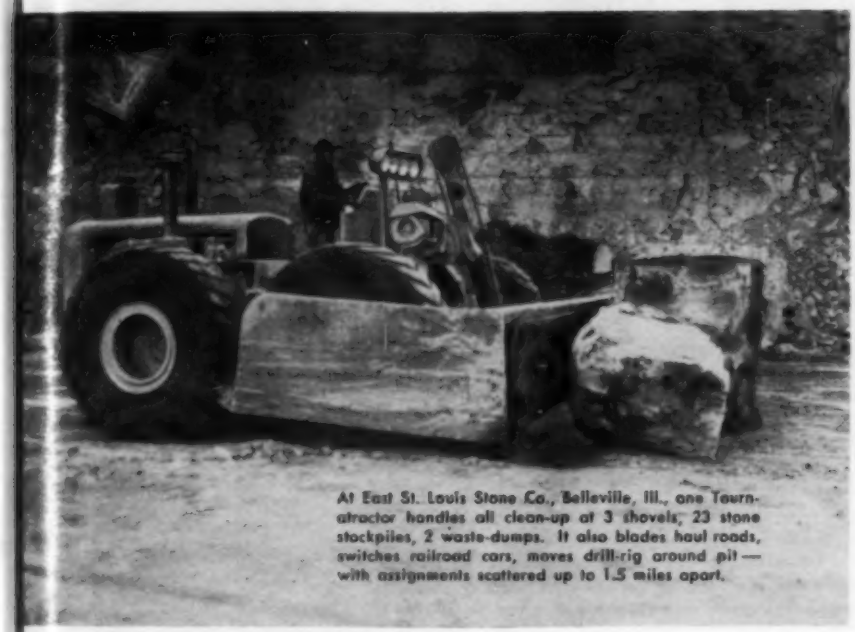
RAYBESTOS-MANHATTAN, INC.

Other R/M products: Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

One Tournatractor — replacing two crawlers — has speeded clean-up at Kaiser Steel Corp's Eagle Mountain Iron Mine in California. Besides servicing 3 shovels, this 210 hp speedster handles jobs like towing compressors and moving frame supports for electric cable.

How to handle scattered pit clean-up and maintenance

at lowest net cost



At East St. Louis Stone Co., Belleville, Ill., one Tournatractor handles all clean-up at 3 shovels, 23 stone stockpiles, 2 waste-dumps. It also blades haul roads, switches railroad cars, moves drill-rig around pit — with assignments scattered up to 1.5 miles apart.

Pit-and-plant "housekeeping" nowadays is an economic must. To maintain profits you need to keep pit surfaces, haul roads, plant yards, and dump areas clean, level, and drained. Good "housekeeping" means faster hauling, greater safety, longer tire and truck life, lower maintenance, faster positioning of haulers, fewer impurities in your pit product. All these add up to more production at lower unit cost.

Scheduling adequate clean-up... at reasonable cost... isn't always easy. If areas needing clean-up are far apart, the machine often given this job — a crawler-tractor — may spend as much time (if not more) just getting *to* and *from* an area as it does *working* there. And no cost-conscious management likes paying a half-hour's costs just for 10 minutes of dozing!

Some pit owners try to solve this problem by keeping crawlers full-time at each location needing frequent clean-up. But owning, operating, and maintaining that many tractors is likely to cost as much as is gained. Even if the rigs used are depreciated veterans — retired from production duty — repair bills mount sharply, and multiple machine operating costs are high.

Soundest solution: right machine

As with many pit problems, the real answer is the *right tool*. Tournatractor® is such a machine. With 17.2 mph travel speed, it gets to scattered job areas *in a hurry*. A half-mile is less than 2 minutes away, a quarter-mile less than a minute. With this LeTourneau-Westinghouse clean-up and emergency unit in your equipment line-up, you can provide high-quality maintenance anywhere and everywhere in your operational area — quickly, easily, economically.

Big, powerful work-horse, too

Fast-traveling Tournatractor has plenty of power and traction to handle any tractor assignment. It delivers 210 hp through an anti-friction power train and torque-converter transmission. Its 4 low-pressure, 2-foot wide, ground-gripping tires provide excellent traction. Blade control is via instant-response electricity. Weight is close to 15 tons.

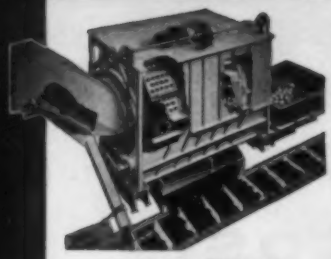
Talk to a LeTourneau-Westinghouse Distributor about your clean-up problems. He'll offer helpful suggestions... give you full facts, and a demonstration, of the modern, high-speed machine designed to solve your hit-and-run clean-up problems in pit, plant, dump and stockpile areas. CT-1645-MQ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

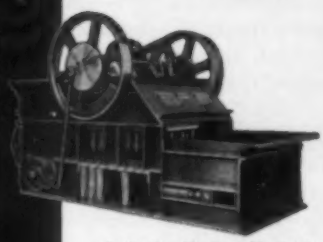
Where quality is a habit

America's most complete line of CRUSHING EQUIPMENT



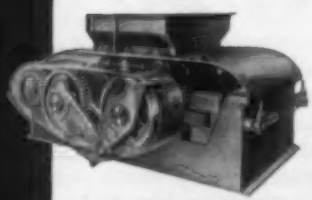
McNally Pittsburg Rotary Breaker

This unit allows positive control of top size in handling run-of-mine washery feed. Production of fines is held to a minimum.



McNally Norton Vertical Pick Breaker

50% Less fines when reducing lump to egg and stove sizes.

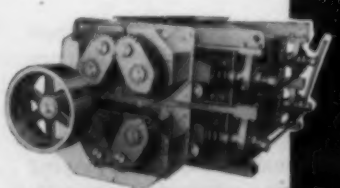


McNally Double Roll Gearmatic ROM Breaker

Built in tonnage ranges from 750 tph to 1400 tph. Full floating gearmatic drive.

McNally Gearmatic Stoker Coal Crusher

This unit offers three prime advantages: high volume production, plus accurate sizing, plus low percentage of fines.



McNally Two Stage Crusher

This unit consists of a double roll primary crusher mounted above a double roll secondary crusher—compactly arranged into a single rigid structure.

Available From Stock and on Short Delivery

For immediate action on complete information write, wire, or call.

McNALLY PITTSBURG MFG. CORP.

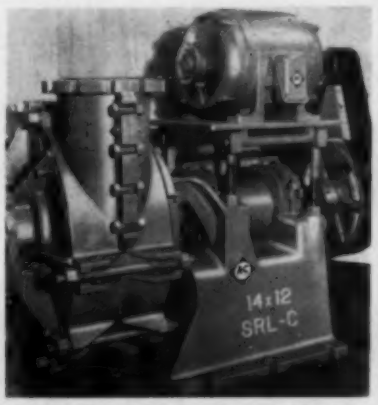
Pittsburg, Kansas Wellston, Ohio

Equipment News (*Continued*)

operating conditions. Benefits include less maintenance, savings on grease supplies and equipment and extended service life for truck wheels, reports the firm.

INSULATION—You get better, trouble-free service, according to Motor Coils Mfg. Co., Pittsburgh, Pa., when wound armatures up to 1,000 hp are vacuum and pressure impregnated with "Epoxi-Mica" insulation. The company immersed a 400-hp, single-phase-AC, semi-closed-slots armature in water six days. Results showed an insulation resistance of 10,000 megs at 3,500 V. Motor Coils' engineers believe this to be the first piece of equipment of its size to be waterproofed with one vacuum pressure impregnation. "Epoxi-Mica" insulation combines natural mica splittings and solventless epoxy resin through this vacuum pressure process. The impregnated wall is cured under pressure, resulting in a void-free, high-dielectric consolidated insulation.

FLITE CONVEYOR—A new, low-cost flight conveyor with prefabricated sections installable to virtually any length or profile has been announced by The Daniels Co., Bluefield, W. Va. Innovations include a total enclosure, thus eliminating spillage, and flexibility of installation due to sectionalized design. Designated Daniels Type C Flite Conveyor, the unit is suited to gathering, distribution, transfer, mixing, blending, bin discharge feeder and all other conventional conveyor applications.



RUBBER-LINED PUMPS—Allis-Chalmers Mfg. Co., Milwaukee, 1, has extended the capacity range of its rubber-lined pumps with the addition of a new 14x12-in unit. The new pump handles heads up to 140 ft at 870 rpm with capacities to 8,000 gpm. It is believed to offer the largest volume, at comparable speeds, of any rubber-lined pump yet available. Other Allis-Chalmers rubber-lined pumps designed for handling abrasive fine-mesh materials such as sand, taconite, slimes or slurries, are available in sizes from 2x2 in to the new 14x12 in unit in open- or closed-impeller models.

(*Continued on p 134*)

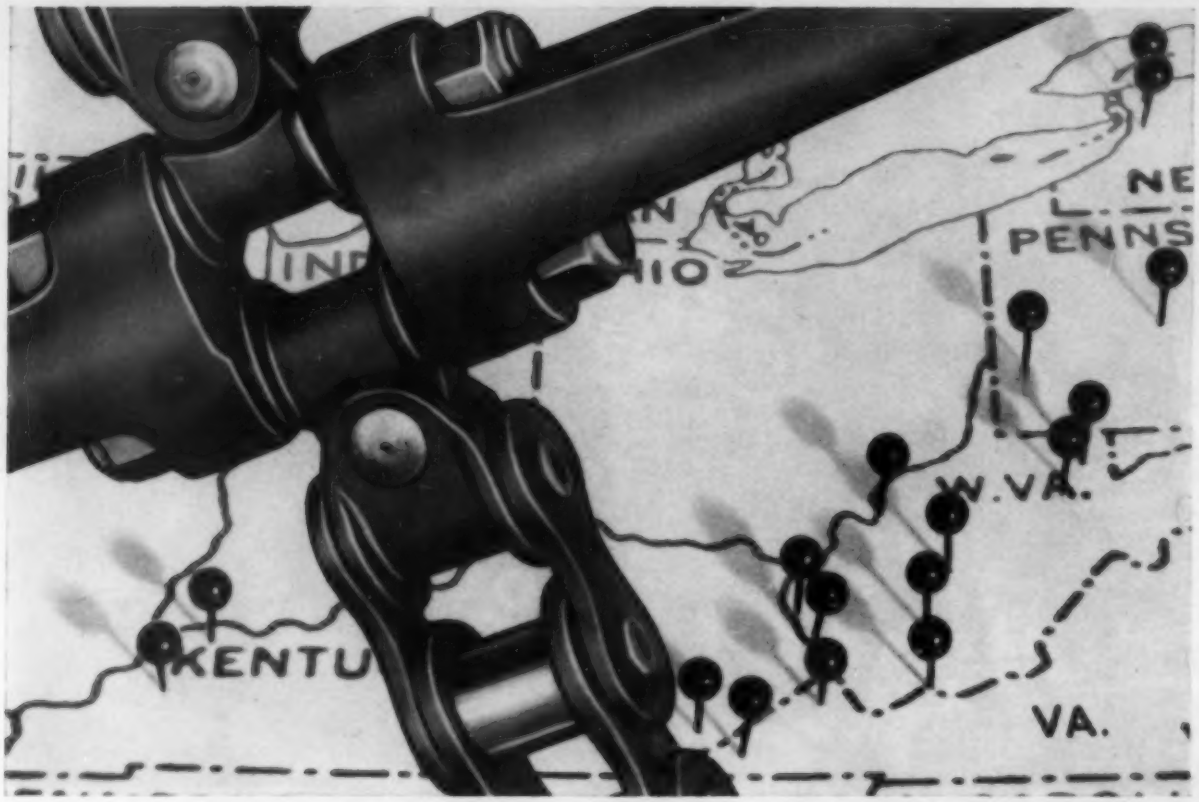
AERIAL VIEW OF GIANT DRAGLINE

A low-flying plane provides this view of a Marion 7800 Walking Dragline at work in a southern Ohio coal stripping mine. The 7800 carries 35 yard buckets on 220-foot booms to meet a variety of special problems involving big yardage and long range.

Marion continues to strengthen its leadership in the coal stripping industry. In addition to draglines of many sizes, Marion manufactures shovels up to the Type 5760, largest shovel in the world. Five Marion 5760 machines are completed or in production.

MARION POWER SHOVEL COMPANY, MARION, OHIO

A Division of Universal Marion Corporation



Whitney Mine Chain Distributors

ALABAMA
Birmingham ..... Owen-Richards Co., Inc.

COLORADO
Denver ..... The Western Belting Co.
Grand Junction ..... Bearing Service Co.

IDAHO
Idaho Falls ..... Bearings Service & Supply Co. of Idaho

INDIANA
Evansville ..... Bearings Service Co., Inc.

KENTUCKY
Harlan ..... McComb Supply Co.
Madisonville ..... Bearings Service Co., Inc.
Owensboro ..... Kentucky Bearings Service, Inc.

MICHIGAN
Marquette ..... Wisconsin Bearing Co.

NEW MEXICO
Carlsbad ... A. D. Guggenheim, Inc. of New Mexico

NEW YORK
Buffalo ..... Buffalo Rubber and Supply, Inc.
Lockport ..... Ward Bros. Mill Supply Co., Inc.

PENNSYLVANIA
Johnstown ..... Quaker Sales Corp.
Reading ..... Reading Mack Distributors
Washington ..... Fairmont Supply Co.

UTAH
Salt Lake City .... Bearings Service & Supply Co. of Utah

VIRGINIA
Andover .... Central Supply Co. of Virginia, Inc.
McClure .... Erwin Supply & Hardware Co., Inc.

WEST VIRGINIA
Beckley ..... The Universal Corp.
Bluefield ..... Fairmont Supply Co.
Charleston ..... Parsingers, Inc.
Fairmont ..... Fairmont Supply Co.
Kermit ..... Controller Block & Supply Co., Inc.
Ravenswood ..... Fairmont Supply Co.
Shinnston .... Erwin Supply & Hardware Co., Inc.
Williamson ..... Parsinger Supply Co.

WISCONSIN
Milwaukee ..... Wisconsin Bearing Co.

There's *Always* A Whitney Mine Chain Distributor Nearby!

Ready with fast, off-the-shelf service!

Whitney Chain distributors are located in key cities throughout all the mining areas. All Whitney distributors carry full stocks of exclusive design Whitney Mine Chain and American Standard power transmission chain. Backed by years of experience, your local Whitney man is a mighty good man to know. He's ready, willing *and able* to service your particular chain needs . . . quickly and economically.

Here's How Whitney Flight Conveyor Chain Saves You Money

- **Detachable flight design prolongs service life. Accurate tapered stud fits solidly as one unit, anchors flight, obsoletes shoulder pins. Quick, easy adjustments or replacement at the face or shop permitted by threaded stud with self-sealing locknuts. Allows you to *salvage flights* from your old chain for more service . . . *more dollar savings!***
- **Forged steel flights and universal joints, 100% Magna-Fluxed and Mar-Tempered for maximum durability under toughest underground conditions.**
- **Whitney mine chain offers you the design advantages and simple maintenance of either riveted or cottered type chain.**

Whitney manufactures the entire product — both chain and flights — to assure complete balanced design, and a fast, complete customer service. Catalogs on request.

Whitney
CHAIN COMPANY

317-H Hamilton Street • Hartford 2, Connecticut

Roller Chain • Double Pitch Chain • Sprockets • Flexible Couplings • Whitney-Tormag Drives

...more profit with every pass

DOES YOUR JOB REQUIRE A 7 YARD UNIT?

CURTISS-WRIGHT MODEL

27

CW-27 SELF-PROPELLED SCRAPER

Capacities: 7 cu. yds. struck, 10 cu. yds. heaped, 26,000 pound rated load

If it does, then your job requires the CW-27 . . . This 7 yd. struck, 10 yd. heaped, self-propelled scraper meets all small yardage requirements — sets a fast 30 mph haul pace on small clean-ups or finishing and will prove itself to be a real companion unit on the big yardage projects . . . Like the entire line of Curtiss-Wright 'plus-yardage' scrapers, the CW-27 boasts such maintenance and production advantages as unit construction, Roto-Gear steer, constant live winch and positive roll-out ejection . . . To insure the utmost from every scraper, Curtiss-Wright engineers to the contractor's requirements . . . To be sure you get the most from all your jobs, check with Curtiss-Wright first!

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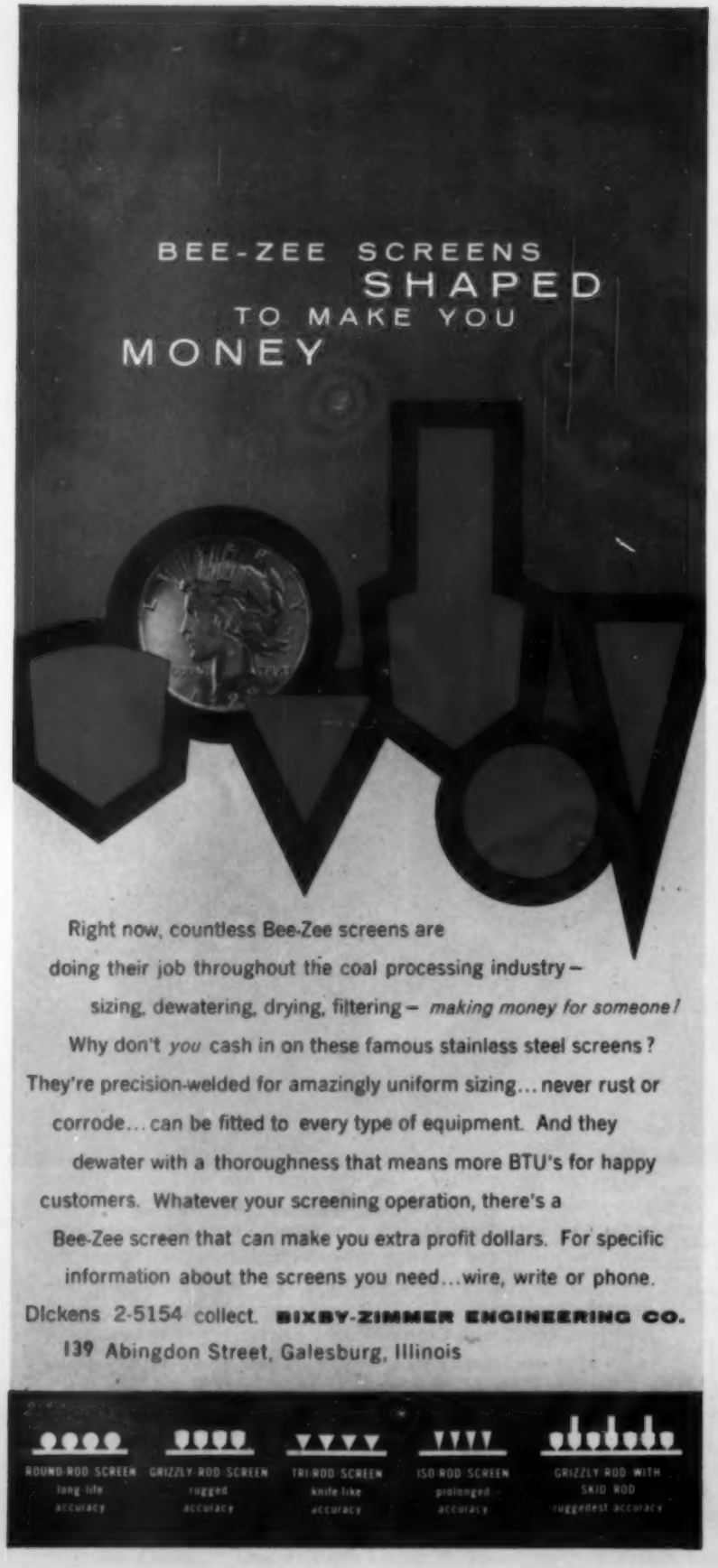
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SHAPED
TO MAKE YOU
MONEY
Right now, countless Bee-Zee screens are
doing their job throughout the coal processing industry –
sizing, dewatering, drying, filtering – making money for someone!
Why don't you cash in on these famous stainless steel screens?
They're precision-welded for amazingly uniform sizing... never rust or
corrode... can be fitted to every type of equipment. And they
dewater with a thoroughness that means more BTU's for happy
customers. Whatever your screening operation, there's a
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Dickens 2-5154 collect. BIXBY-ZIMMER ENGINEERING CO.
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long-life
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knife-like
accuracy
ISO-ROD SCREEN
prolonged
accuracy
GRIZZLY ROD WITH
SKID ROD
ruggedest accuracy

Equipment Shorts

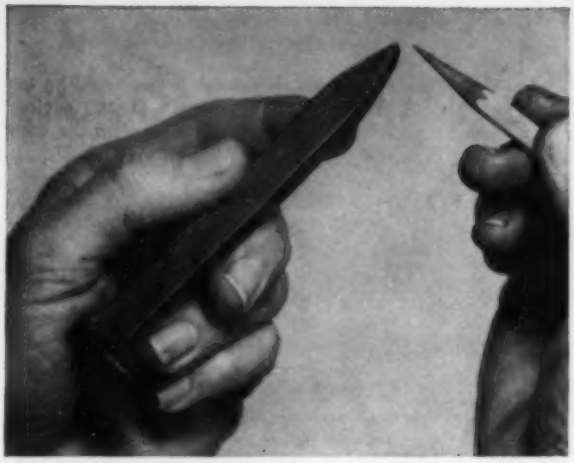
Plastic Mike—A new lightweight, plastic microphone is now standard equipment with all General Electric (Lynchburg, Va.) "Progress Line" mobile two-way radio units. Replacing conventional metal types, they are built to withstand extreme conditions of vibration and corrosion and use a controlled magnetic cartridge which has, according to the firm, proved markedly superior to the previous microphone in intelligibility and reliability.

Impact Crusher—Joy Mfg. Co., Pittsburgh 22, which recently entered the minerals-dressing field with a high-tension iron-ore separator, has been licensed to sell an allied product, the Hazemag Impact Crusher, made by The Hazemag Co. of West Germany. The Joy-Hazemag machine has a fast-turning rotor equipped with blow bars that impacts against the feed. The feed is thrown against gravity-hung impact plates suspended pendulum fashion inside the large crushing chamber. Material is reduced to the exact required size by adjustment of impact plates and rotor speed. Both these variables may be changed from outside the machine during operation. Crushing of coals to greater than 90% through ⅛-in while limiting production of fines (–100 mesh) to a minimum is possible.

Pressure Gages—Dill Mfg. Co., Cleveland, is producing three new tire pressure gages including: a standard-bore dual-foot gage; an oversize and standard-bore push-on gage; and an oversize and standard-bore dual-foot gage. All come in either high- or low-pressure ranges.

Gate Valves—New stainless-steel split-wedge gate valves are announced by Jenkins Bros., New York 17. The valves are made of Types 316 and J-20 alloys which withstand a wide range of corrosive conditions and are fitted with a split wedge of ball-and-socket design to automatically adjust to tapered seating surfaces. Featured is a two-piece packing gland design eliminating binding of the follower when gland bolts are tightened unevenly.

Generating Plants—New from D. W. Onan & Sons, Inc., Minneapolis, Minn., is a series of water-cooled diesel-driven electric generating plants. Series DZB machines are available in 10,000- or 15,000-W size ranges, AC, and in all standard 60- and 50-cycle voltages to 460 V. Completely self-contained, the plants



for sharp points

strong heads

for clean, smooth-fitting threads

strong necks and heads

for quick delivery of the sizes you need

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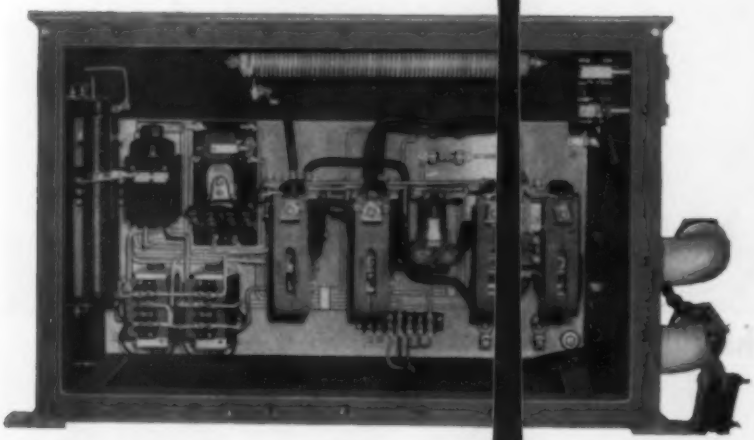


Photo illustrates Ensign Bulletin 5391 magnetic reduced voltage starter — 250 Volt D.C. — 3 points acceleration — non-reversing — Bureau of Mines explosion tested enclosure.

features -

ENSIGN type EJ contactors

ENSIGN mercury timing relays

ENSIGN intrinsically safe relay

ENSIGN
ELECTRIC AND MANUFACTURING CO.

914 Adams Avenue Huntington 4, W. Va.

Equipment News (*Continued*)

use the heavy-duty 3-cylinder 37-hp (at 1,800 rpm) Hercules D. D. 149 engine. A 12-V battery-charging generator with automatic charge-rate regulator also is included.

Air Motors—Joy Pistonair five-cylinder radial air motors for heavy-duty service are now in production at Joy Mfg. Co., Pittsburgh 22. They combine high starting torque and sustained load-lugging ability with a simple throttle valve control allowing instant starts and stops, unlimited reversibility and infinitely variable speeds. Ratings range from 11 1/2 to 20 hp at 90 psi. Direct-drive models turn at 400 to 800 rpm at rated horsepower with stall torques from 225 to 162 ft-lb. Weights are from 230 to 289 lb. Geared-drive foot-mounted models give choice of five gear-reduction ratios from 4.1:1 to 21.5:1. Output shaft rpm at rated hp ranges from 19 to 200 with stall torques of 4,837 to 648 ft-lb. Weights run from 485 to 495 lb.

Free Bulletins

"Do-it Yourself"—Building your own automatic car-loading unit is the subject of a booklet recently published by The Nolan Co., Bowerston, Ohio. For use by mining companies, the booklet was prepared in recognition of the need for savings in operating costs. Nolan is offering the mine operator on a "build it yourself" basis genuine Nolan components either for complete automatic loading-station units or to supplement any structural parts the operator may care to build himself from Nolan plans. Illustrations and descriptions in detail of such loading station components as hopper and fly gate, car change switch assembly, automatic panel control and derail and out-of-car control highlight the publication, which the firm offers free upon request.

Shuttle Cars—A pictorial brochure with charts giving facts and figures on their 36- to 48-in-high shuttle cars can be obtained by writing to Goodman Mfg. Co., Halstead St. & 48th Pl., Chicago 9.

Torque Converters—Getting the most out of shovel-cranes with torque converters is discussed extensively in a new 16-p booklet. Written in nontechnical language, it offers tips to assist operators in getting greater production with less effort from machines equipped with engine-converter combinations. Link-Belt Speeder Corp., Cedar Rapids, Iowa., Book 2740.

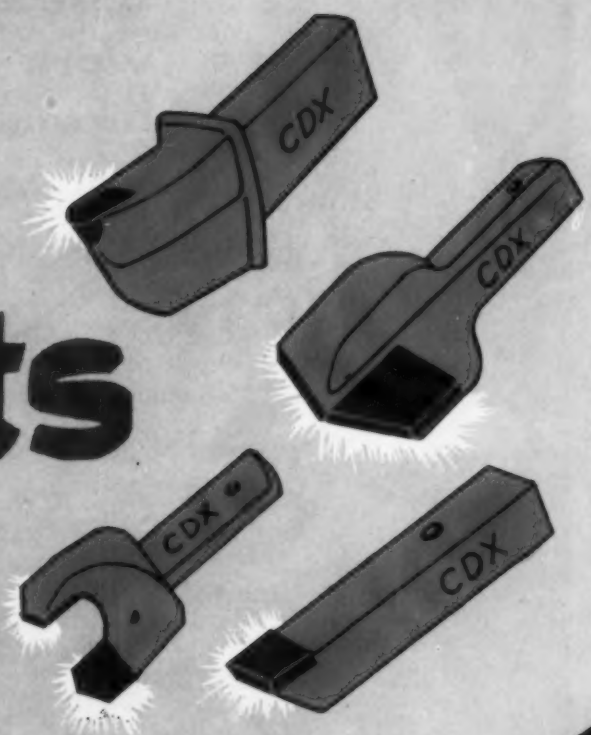
Tractor Accessories—This booklet of 12 pages contains facts and figures on

UNIFORM QUALITY...
CONSISTENT PERFORMANCE...
MAXIMUM SERVICE...

you get them all with

CARDOX.®

carbide-tipped **bits**



Job-proven to give you *more* . . . in production, performance and service! In "show-down" tests in mine after mine, Cardox bits maintain a lower "cost-per-foot cut or drilled" rating than any other. It's no secret why . . . Cardox carbides are job-matched to meet your specific mining requirements, whether it be drilling or cutting. They are made to uniform quality standards . . . bit after bit, they deliver the same consistently high production output, the same long service life. They make continuous mining more continuous. Want proof? We'll be glad to run a test at your mine. You name the time, place and conditions. Bits available in all sizes and styles.

and

heat-treated alloy steel

augers

The all-new Cardox roof auger gives you 2-to-1 peformance over all others. Strong, rugged, long-lasting . . . Cardox roof augers are constructed of tough alloy steel, welded—then heat-treated for added strength and abrasion resistance. An extra pitch of flight at the shanks end provides added strength at the point of stress. In standard lengths from 10" on up; other Cardox augers are available from 1¼" to 48" in diameter. Same high quality, same high performance.

immediate service

lasting satisfaction

You can rely on Airdox-Cardox for straight practical answers to your mining problems. We offer you a unique combination of experience, know-how, broadest distribution and stocking facilities, and available qualified underground personnel to answer your needs efficiently, effectively and economically. Call on us . . . where there's coal, there's . . . AIRDOX-CARDOX!

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Phone: St. Clairsville 619

Louisville, Colorado
Phone: Boulder Hillcrest 2-7298

Camden-on-Gauley, W. Va.
Phone: Camden-on-Gauley 2181

Benton, Illinois
Box 537
Phone: Benton 8-3821

Pikeville, Kentucky
Route 2, Box 571
Phone: Robinson Creek #5

Library, Pennsylvania
Box 427
Phone: Tennyson 3-6910

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OTHER AIRDOX-CARDOX PRODUCTS . . . Airdox and Cardox Non-Explosive Mining Methods . . . Auger Miners . . . Rotary Drills
Cardox Central Compression Systems for Air, Helium and other Gases

Two 6-yard draglines move 4,992,000 yds. per year . . . work 6-day, 21 hour shifts... Downtime measured in hours

Equipped with 6-yd. buckets and 100′ booms, each dragline averages slightly more than one pass per minute.

Model 3000 shovel with 35′ boom and 27′ dipper sticks removing shallow overburden. Unit works up to two 8-hour shifts daily.

Model 3500 shovel has a maximum reach of 40′ and operates two eight to nine hour shifts each day.

"There's no question but that the Manitowoc Model 4500 dragline just can't be beat for a 6-yard machine in an operation like ours," says Mr. W. P. Stahlman, owner of the W. P. Stahlman Coal Co., Corsica, Pa. Proof of Mr. Stahlman's statement is found in the company's output records. Using two of the 6-yd. Manitowocs, over 16,000 yards of overburden, from 10 to 70 feet deep, are removed daily. Operating a 21 hour day, six days a week, that means the two draglines remove close to five million yards a year! ▪ "Despite the fact that we are using the draglines constantly, every week of the year, downtime can be measured in terms of several hours per year," Mr. Stahlman noted. ▪ In addition to minimum maintenance, the two 6-yd. diesel powered, Manitowocs offer on-the-job and between job mobility that can't be matched by electric machines. When moving from one coal seam to the next, the 4500's crawl under their own power without extensive preparations and with a minimum time loss. When transported from one job to another they can be loaded on trailers or flat cars with minimum disassembly. ▪ You can get more output and operating economy like this at *your* mine . . . your Manitowoc distributor has all the particulars. Call him now!

STAHLMAN'S 4-MACHINE MANITOWOC TEAM

2 Model 4500 6-yd. Draglines
1 Model 3500 Hi-Lift Shovel with 2-yd. dipper
1 Model 3000 Hi-Lift Shovel with 1¾-yd. dipper

Manitowoc

MANITOWOC ENGINEERING CORP.
(A subsidiary of The Manitowoc Company, Inc.) **MANITOWOC, WISCONSIN**

SHOVELS 1¼-Yd.—5½-Yd. ● DRAGLINES 1¼-Yd.—6 Yd.

Profile of a man

who can help you solve mining problems with top-performing Amoco Lubricants

This man is a specialist. He belongs to Amoco's "task force" of expert mine lubrication engineers. If you have any kind of lubrication problem, he's ready to make a survey *at no cost to you.*

His goal? To simplify the number of lubricants you need and to reduce your maintenance costs. For instance, Amoco Leaded Lubricants have unusual extreme pressure characteristics and extra oiliness qualities, plus ease of handling at low temperatures. Your Amoco man is apt to recommend it for universal joints and gear cases of loading machines, shuttle car wheel units, worm gear speed reducers, heads and gear cases of mining machines and open gears.

Or he can give your mine machinery better lubrication with such famous Amoco products as Paramo Oils, Amolite Oils and Amerilube Greases. You'll find the Amoco line is complete, takes in every requirement in strip or deep mining, from leaded lubricants to the exact oil required for diesel engines. You'll find it pays to call in your Amoco Mine Lubrication Engineer. Call your nearest Amoco office or write American Oil Company, 555 Fifth Avenue, New York 17, New York.

AMOCO

LUBRICANTS

FOR MINE MACHINERY

AMOCO®

WHEN YOU WANT TOP PERFORMANCE, YOU WANT AMOCO

Equipment News (*Continued*)

Allis-Chalmers attachments and accessories for crawler tractors and motor graders. Pictures and discussion are aimed at increasing working capabilities various machines as well as adding to the safety and comfort of operators. Catalog MS-1189, Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee 1.

Efficient Filters—This recently published booklet describes three types of mechanical filters: Type F, Airmat Deep Bed, and the Multi-Pac. American Air Filter Co., Inc., 215 Central Avenue, Louisville 8, Ky. To get this bulletin with illustrations and explanation of media and full assemblies, write to the firm, Dept. PD, specifying No. 238.

Waste Treatment—Now available is a new 24-p brochure featuring Process Engineers, Inc's. line of Clarifier and Oxidator mechanisms for water, sewage and industrial waste treatment. In it are described basic types covering a full range of tank sizes and load requirements, and units for unusual conditions. The firm, located at 420 Peninsular Ave., San Mateo Cal., is a division of Eimco Corp. Ask for Booklet, SM-1005.

CONNELLSVILLE SKIPS
...40 Million Ton Performance -Still Going Strong!

▲ International Minerals & Chemical Corp. recently hoisted the 40,000,000th ton of potash ore from the company's No. 1 Mine at Carlsbad, N. Mex. Equipped with Connellsville 13-ton Bottom Dump Skips, one shaft at the mine delivered as much as 14,464 tons in a twenty-four hour period!

For over 42 years, Connellsville Skips have established a record for unmatched performance and durability. Designed to meet specific haulage requirements, Connellsville Skips are safe, rugged and dependable through years and years of service . . . engineered for high speed and trouble-free operation.

Installing a new shaft? Revamping an old shaft? Either way, specify Connellsville Skips and profit through increased tonnage and low maintenance operation.

Connellsville Skips—*doing yeoman service from one end of the mining industry to the other.*

Raising Production SINCE 1901 Connellsville MANUFACTURING

CONNELLSVILLE MANUFACTURING & MINE SUPPLY CO. / Connellsville, Pa.

Grouser Plates—Bulletin No. 1061 describes in full detail the features of Kensington grouser plates. Highlight of these plates is their wear-resistant qualities. Kensington Steel Div. of Poor & Co., 505 Kensington Ave., Chicago 28.

Inspecting Wire Rope—Service life of wire rope can be increased substantially by a proper program of inspection according to Red-Strand Service Bulletin No. 104. The booklet explains the importance of regular inspections and points out various things to look for when inspections are made. Evaluation of findings is also discussed in this catalog available from Leschen Wire Rope Div., H. K. Porter Co., Inc., 2727 Hamilton Ave., St. Louis 12.

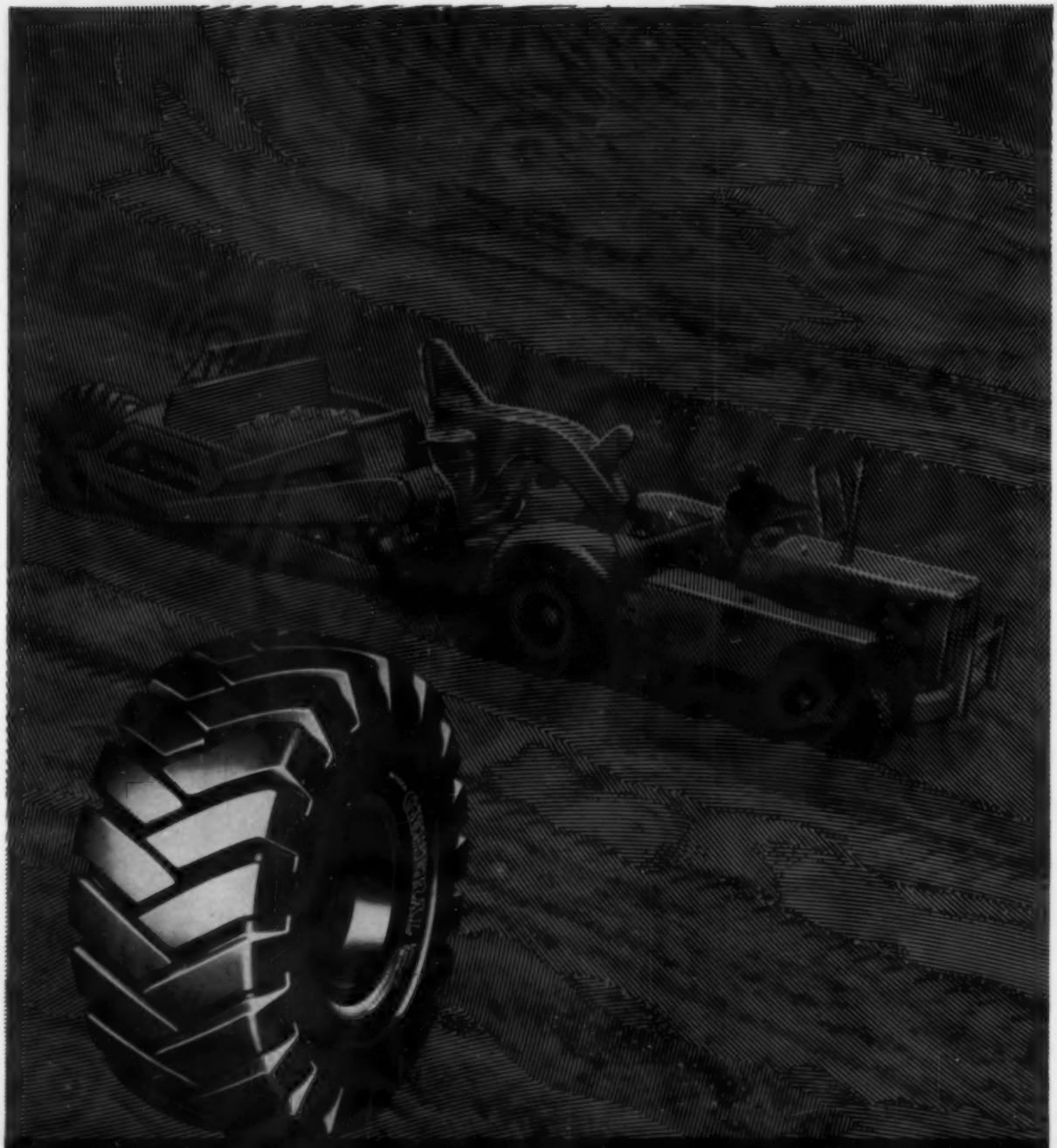
Vibrating Equipment—A 96-p book covering the Jeffrey line of electric vibrating feeders and conveyors is now available. Controls, installation methods, principles of operation and individual unit specifications are included. Other vibrating equipment, such as, magnetic separators and bin-level indicators are also covered. Jeffrey Mfg. Co., Columbus 16, Ohio.

Continuous Miner—Modifications of the Joy 5CM continuous miner, including integral roof-bolting drills and gathering-arm cleanup, are described and illustrated in a new specifications sheet. Complete specifications on the miner as well as on rigid and tilting roof drills are included. Bulletin J-409, Joy Mfg. Co., Oliver Building, Pittsburgh 22.

Plastic Pipe—This 6-p illustrated bulletin, HT-100, with pictures, tables and charts, describes advanced new high-strength rigid plastic pipe for operation at higher temperatures and pressures than any other thermoplastic pipe, according to its producer, Carlon Products, Corp., P. O. Box No. 133, Aurora, Ohio.

Reducing Flashovers—You can get a compact brochure with information on how Dow Corning 5 compound curtails arcs, shorts and formation of leakage paths exposed to contaminated atmospheres. Applications and advantages are fully discussed in this illustrated brochure. Dow Corning Corp., Midland, Mich. (Code 4-215).

Protective Coatings—A completely revised 4-p bulletin on protective coatings. It provides a breakdown of the four classifications of corrosive conditions according to severity of exposure and offers a simple chart facilitating selection of coatings according to service requirements. Bulletin 100, Carboline Co., 32 Hanley Industrial Court, St. Louis 17, Mo.



Proved again and again over the roughest, rockiest going in all the world, **GENERAL** Truck Tires are NYGEN® - built to get every job done faster and for less whether it be in logging, construction, quarrying or mining.

Specify GENERALS on your new equipment

THE GENERAL TIRE & RUBBER COMPANY, AKRON, OHIO

Easiest haul... from pit to bin!

Between mine and consumer stand many coal-moving jobs that call for modern Dodge "Job-Rated" trucks! Dodge for '59 brings you a truckful of new chassis toughness, new engine efficiency, new cab comfort. Offered with single or tandem rear axles, these powerful trucks and tractors are rated to 49,000 lbs. G.V.W. and 65,000 lbs. G.C.W. Equipped to your exact specifications, you'll find Dodge second to none for cutting hauling time and costs in a host of coal-moving operations.

Famous dependability makes Dodge thrifty and easy to maintain. Low prices and liberal terms make Dodge thrifty and easy to buy. Check with the Dodge dealer nearest you. Learn the many more reasons why . . .

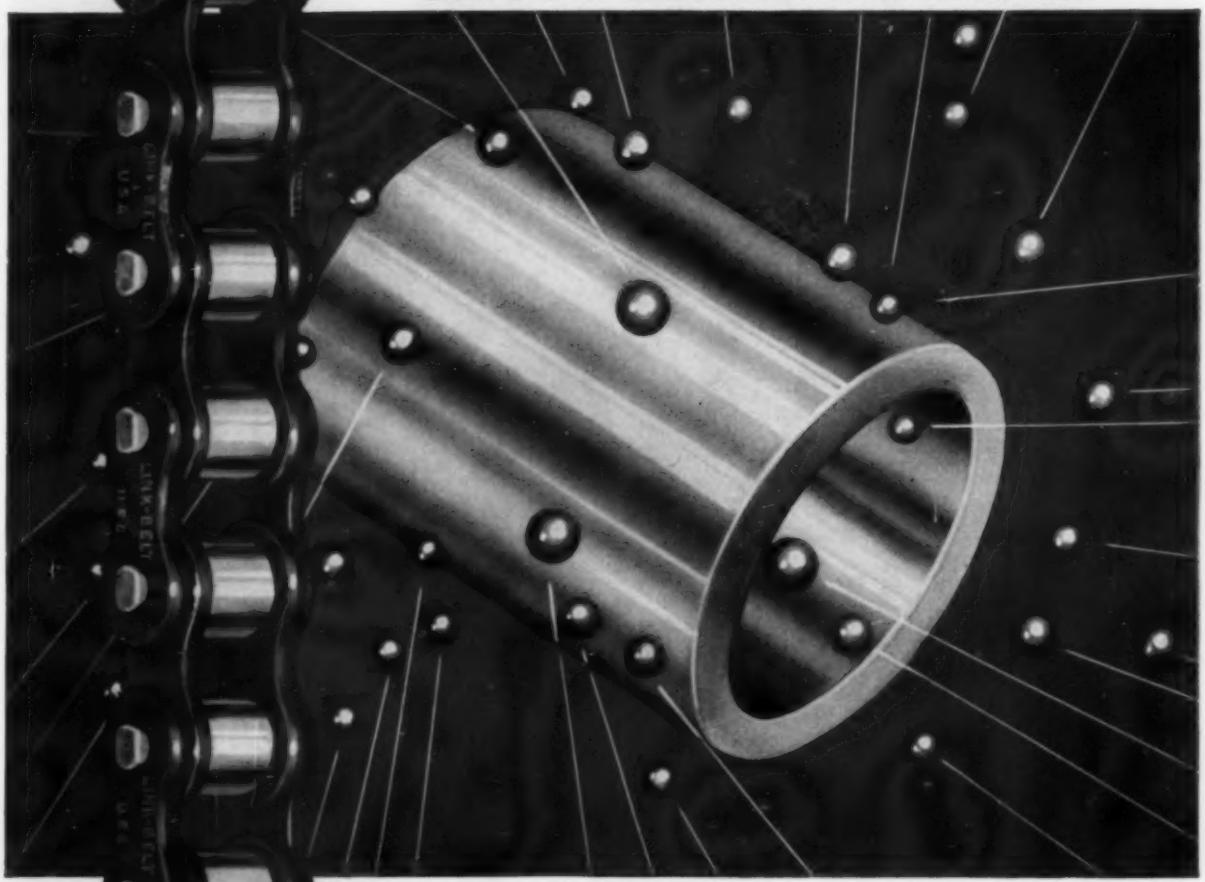
today,
it's real smart
to choose Dodge
Trucks

There's power to stop your loads as well as move them, in Dodge trucks! Big brake lining areas, as much as a whopping 1004.85 sq. in., mean safer stops. Improved air brakes with larger air chambers and longer slack adjuster levers are standard on all air brake models.

Shining example of "extra" chain quality

SILVER-BRITE

SHOT-PEENED ROLLERS



EXTRA LIFE IS POUNDED IN AND NOT POLISHED OUT

Rollers for Link-Belt precision steel roller chain are now finished by a special burnishing process to a "Silver-Brite" luster! And this is accomplished *without grinding away the benefits imparted by shot-peening*—a Link-Belt process that cold works the metal and provides extra fatigue life

Many more special Link-Belt "extras" contribute to the dynamic strength so important for today's heavy loads and high speeds: close heat-treat control . . . lock-type bushings . . . pitch hole preparation . . . pre-stressing.

Ask your Link-Belt office or authorized stock-carrying distributor for new 154-page Catalog 2657—the most complete roller chain data book ever compiled.

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ROLLER CHAINS & SPROCKETS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 14,070

Among the Manufacturers

Western Services, Inc., Mt. Carmel, Ill., has been appointed distributor for the Detroit Diesel Engine Div. of General Motors in 12 additional counties of southwestern Indiana.

A complete line of GM "Jimmy" diesel engines, parts and service is available on a 24-hour round-the-clock schedule. Indiana counties now being served by Western Services include: Sullivan, Greene, Knox, Davies, Martin, Gibson, Pike, Dubois, Posey, Vanderburgh, Warrick and Spencer.

Rome Cable Corp. and Aluminum Co. of America have announced plans to affiliate.

Alcoa will acquire all the properties of Rome Cable for 355,226 shares of Alcoa common stock if Rome shareholders approve the agreement on March 25. The two firms plan to combine their electrical conductor, conduit and accessory activities in a new company called Rome Cable Co. No major changes in personnel or operating procedures are anticipated.

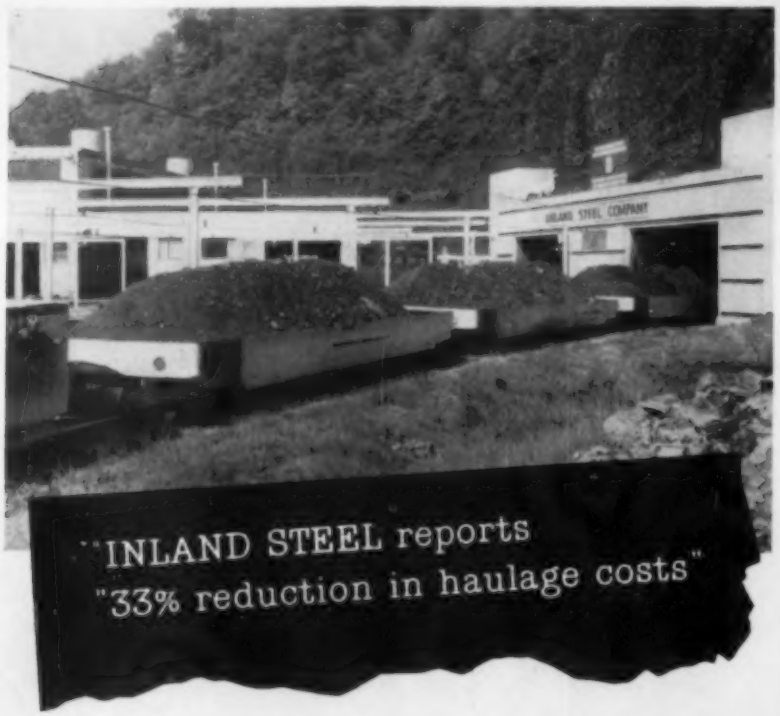
Louis J. Ott

The election of four vice presidents has been announced by the Ohio Brass Co., Mansfield, Ohio.

Louis J. Ott, elected vice president, will also continue as general sales manager. Mr. Ott has been with Ohio Brass since 1927 gaining experience in several factory departments before becoming part of the advertising department in 1928. He was chosen as sales manager in 1949. **Joseph T. Lusignan,** elected vice president, engineering, will continue to head all O-B engineering activity. **Estes C. Thompson,** named vice president, manufacturing will continue to direct this field, and **J. Howard Holan,** elected to vice president, will also continue as treasurer of Holan Corp., an O-B subsidiary.

John Cosgrove takes over the Huntington, W. Va., area as district sales manager for Goodman Mfg. Co.

Mr. Cosgrove has been with Goodman since 1948, the last six years in



SOUND LIKE A GRAVY TRAIN? Maybe so, but it's actually down-to-earth mine car trains that we're talking about.

Inland made exhaustive studies over a three year period . . . came to the sober conclusion that their mine car investment "would be returned in 2½ to 3 years."

The well loaded trip shown above is a part of the 526 *additional* cars purchased by Inland for its Wheelright Mine as a result of its experience with Differential cars in their Price #2 mine.

Standing out like a miners' lamp underground is the irrefutable, hard fact that for any given length, width and height mine car you can haul more tons of payload in a Differential than in any competitive make. Make us prove it!

It's the popular "Axless" truck design that makes the difference in Differential. Leaves more room within the car for revenue producing coal. Look into the Differential deal—it's sound as a dollar!

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SINCE 1915 PIONEERS IN HAULAGE EQUIPMENT

Equipped with free-cutting Kennametal* U7J and J2 style bits, this Jeffrey Colmol loads a 2½-ton shuttle car in 30 to 40 seconds.

"Sure, bit costs are important . . . but it's tonnage that pays the bills"

Bit-cost-per-ton is at a new low but this company† buys Kennametal Bits primarily because of the way they cut coal

In Indiana County, Pennsylvania, the Miller "B" Seam averages 42 inches, and is characterized by a sulfur streak in the middle. This streak varies anywhere from a feather to about two inches thick. While the roof is fairly good, frequent bottom rolls of hard fire clay extend from 4 to 22 inches up into the bed. Under these conditions, the company had difficulty finding a long-lasting bit that would satisfactorily cut this seam. Not only did the machine have a slow rate of advance, but the heavy strain on the cutter heads resulted in an excessive power load. Then the company tried Kennametal Bits and not only obtained good production but relieved the excessive strain on the machine.

Ask your Kennametal Representative how Kennametal cutter bits and drill bits can improve *your* production. Let him help you select and actually test in your mine the Kennametal Bit designed to match your operating conditions. Call your Kennametal Representative or write KENNAMETAL INC., Mining Tool Division, Bedford, Pennsylvania. 8703

*Trademark †Clymer No. 2 Mine, Morrisdale Mining Company

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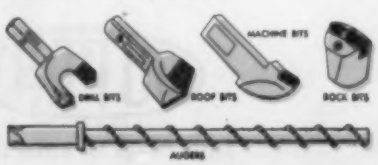

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When products of neoprene replace ordinary rubber products, you can expect longer service life and economy, plus safety. Take conveyor belting, for example:

Savings of $8000 a year were obtained when a West Virginia mine used flame-resistant neoprene conveyor belting. Because it does not support combustion, neoprene eliminated the need for walling up cross ducts.

For 17 years a neoprene belt has carried oiled coal for a New England company. Because lubricants and oily coal will not deteriorate neoprene, it has protected the fabric from water, mildew and mechanical damage.

In surface conveying systems, neoprene's sunlight and weather resistance has also resulted in savings for the coal industry. Neoprene offers the same durability in air hose, V-belts, trailing cable, packings, brattice cloth and ventilating tubing.

Be sure to specify neoprene when you replace your conveyor belting, or buy new equipment. Neoprene's combination of properties means added economy and safety. For additional information, write for "Du Pont Elastomer in Industry," E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept., CA-3, Wilmington 98, Del.

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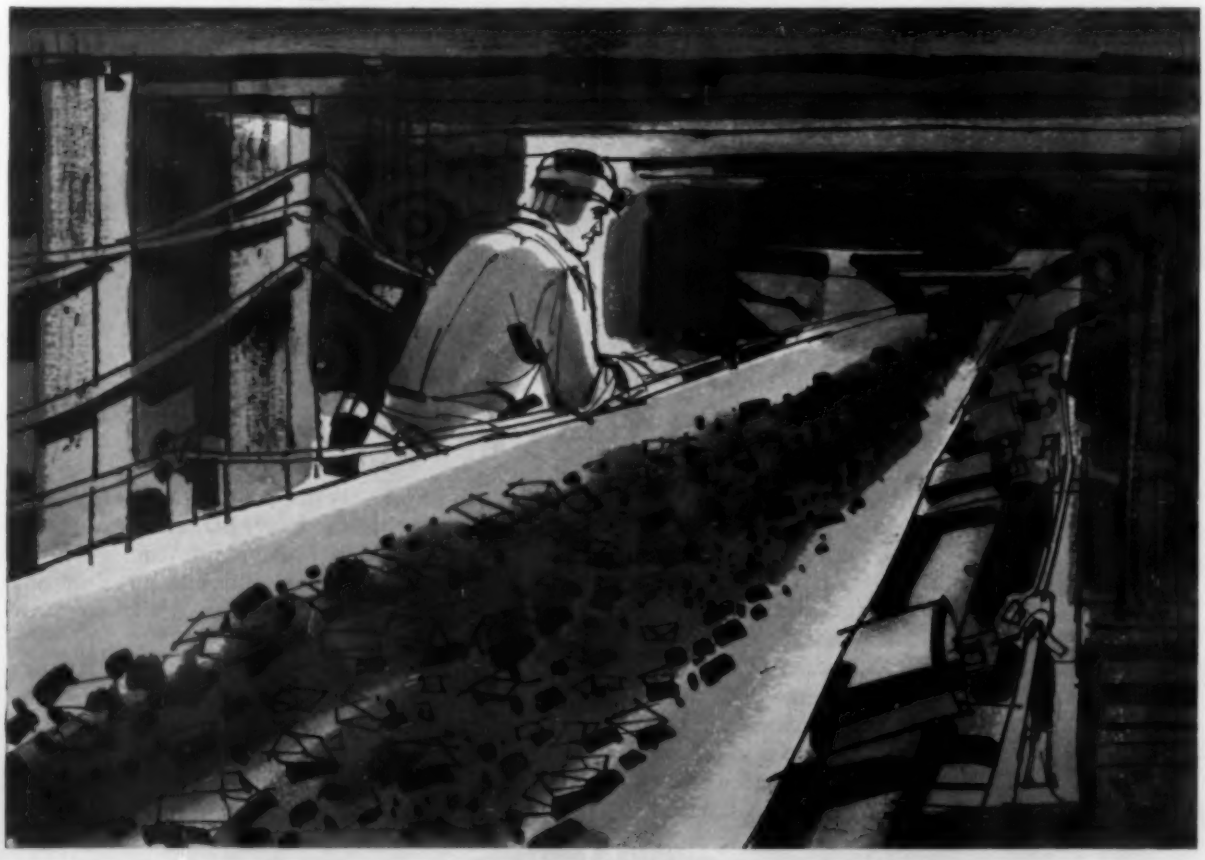

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Unmatched holding power on the shaft...

New mounting simplicity.

The rims, discs and hubs of these modern conveyor pulleys are *steel*—and they are fused together into jointless drum construction for (1) maximum strength with minimum weight, (2) exclusion of dirt, water, steam, (3) terrific shock resistance.

With the patented Dodge Back-up Bar, welds of full rim thickness are achieved—and the ultimate in strength is assured by submerged arc process welds.

Taper-Lock Steel Conveyor Pulleys *hold*. Taper-Lock provides the equivalent of a shrunk-on fit—there is no "walking" on the shaft. Mounting and demounting are simple. Pulley and bushings mount as a unit. Alignment is easy. And the tapered bushing is wedged into place merely by turning the mounting screws. It is "unlocked" by using the mounting screws as jack screws.

Available in diameters from 6 inches to 8 feet—all face widths. Standard or special rubber lagging available. Ask your local Dodge Distributor—or write us for bulletin.

DODGE MANUFACTURING CORPORATION, 3000 Union, Mishawaka, Ind.

97 Taper-Lock Steel Conveyor Pulleys are used in this famous conveyor system engineered, manufactured and erected by Hewitt-Robins, Inc., at the Southern Pacific's causeway construction across the Great Salt Lake.

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of Mishawaka, Ind.

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Manufacturers (*Continued*)

the Huntington area. Prior time was spent in the northwest United States and western Canada as well as in South Africa.

Dr. N. B. Sommer has been appointed manager of American Cyanamid Co.'s Explosives and Mining Chemicals Dept. and George C. Holton has been named assistant to the general manager, Organic Chemicals, Div.

Dr. Sommer, formerly assistant to the executive vice-president has been with the firm since 1944. Mr. Holton, with Cyanamid since 1934, served the firm's explosive department in various capacities during those years.

Bird Machine Co. has elected Calvin A. King president of the firm, to succeed F. K. Becker, retiring president, who will continue on the board of directors.

Mr. King joined Bird machine 13 yr ago and recently served as first vice president. He was in charge of the firm's Research and Development Center when it was built, staffed and equipped. The center played a leading part in developing of the Bird con-

tinuous, solid-bowl coal filter and the Bird-Humboldt oscillating-screen centrifuge for dewatering fine coal.

Ray Munger has been named manager, Mining Research and Development Div. of the Jeffrey Mfg. Co.

With Jeffrey since 1939, Mr. Munger holds a BS degree and has most recently served as assistant manager. He succeeds **Sterling C. Moon** who passed away.

Robert W. Eager has been named vice president, manufacturing, of Joy Mfg. Co.

He will be responsible for supervising the corporation staff service to the operating divisions of Joy on matters of manufacturing, production control, purchasing, traffic and plant engineering.

Charles C. Whaley died December 27, 1958, at the age of 77.

Mr. Whaley had been with the Myers-Whaley Co. from 1919 to 1954, retiring then on account of health. He had many friends in the coal industry and took a leading part in the mechanization program of the mines.

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1—American Mine Door, Wheel mounted bantam type rock duster, 250 Volts, D.C. 22" high.

HOISTS FOR SALE

10—#11½ Vulcan-Denver Material Hoists, Complete with 3 H.P. D.C. Compound Wound 1750 RPM General Electric Motor.
2—Brownie Hoist, Model HKL—good condition.
1—Brownie Hoist, Model HKM—good condition.

ELEVATORS FOR SALE

2—Joy PL11-16 Elevating Conveyors.
2—Barber-Greene Self-Propelled Elevators, 30' long, gasoline or electric.
1—Barber-Greene Self-Propelled Cat Mounted, self loading—gasoline driven.

CAT TRUCKS FOR SALE

4—T2-5APE Joy Truck, 250 Volt D.C. Permissible.
2—T1 Joy Trucks, A.C.
1—T2-5 Cat Truck, 220/440 Volts AC.

BELT CONVEYORS FOR SALE:

1—97C-30 Goodman Belt Conveyor 1200' long, 20 H.P. Tandem Drives. Complete with belt.
2—52B Jeffrey Tandem Heads only.

CHAIN CONVEYORS FOR SALE

5—61AM Jeffrey Chain Conveyors, 10 H.P. 300' long.
3—61HG Jeffrey Chain Conveyors, 5 H.P. 40' long.
2—Long 12" Piggyback Conveyors, each 300' long, complete with PT-12 Piggybacks & 12BU Joy Loading Machines.

DIESEL PLANTS FOR SALE

1—100 KW Diesel Generator Unit, with G.M. Diesel Engine and 100 KW Generator.
1—D13000 Caterpillar Diesel Generator Units —with caterpillar engine and 75 KVA Louis Allis generator self regulating.
1—60 KW General Motors Diesel Driven Generator Set, 250 Volts, D.C., Direct Connected, Complete with switchgear.
1—250 KW Diesel Generating Plant, consisting of Westinghouse 250 KW 275 Volt Compound Wound Generator, driven by Twin 6110
General Motors, Engines. Complete with switchgear and all appurtenances. New in 1956.

MOTOR GENERATORS FOR SALE

1—300 KW Westinghouse Motor Generator Set, synchronous motor, 433 KW Output, 435 KVA, 2200 Volts, 1200 RPM. D.C. generator 300 KW, 275 Volts, 1200 RPM. Compound Wound. Complete with D.C. panel and switch gear.
2—300 KW Portable Motor Generator Sets, 2300/4000/4160, A.C. & D.C. Automatic.
3—50 KW G.E. & Westinghouse Motor Generator Sets, 2300 Volts A.C., 275 Volts D.C. Complete with switching gear.
1—200 KW Ridgeway Motor Generator Set, Complete with manual brakers A.C. and D.C. Switchgear 2300/4000 Volts A.C. and 275 Volts D.C.
1—200 KW Ridgeway Motor Generator Set, Complete with switchgear and 1600 amp. I-T-E automatic circuit breaker, 2300 A.C., 275 Volts D.C.
1—50 KW Westinghouse MG Set, 440 Volt AC, 275 Volt DC.

MISCELLANEOUS FOR SALE

100—AC&F 7 Ton Capacity 42" Track Gauge Drop Bottom Mine Cars.
1—24" Fan with drive.
15—AC&F 3 ton Capacity 42" Gauge, Drop Bottom Mine Cars 26" High.
150—Sanford Day 5 Ton Capacity Bottom Dump Mine Cars, 42" Gauge, 40" High.
2—5 H.P. Tricycle Type Rubber Tired Mine Tractors, 5 H.P. 220 Volt Single Phase Motors and 3 End Dump Cars 17" High.
1—TD 14 International Bulldozer.
1500' 36" Belt
1500' 30" Belt

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MINING EQUIPMENT

2—7B Cutting Machines D. C.
1—Goodman Shearing Machine D.C.
2—8 BU Loading Machines D. C.
1—100 K.W. Gen. Elec. M.G. Set 250-275 D.C.
1—Ottumwa Hoist

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TRACKLESS EQUIPMENT

1—11RU Joy Cutting Machine, 9' Bar, 250V. D.C.
5—Long 88 Pig Loaders
2—20BU-3E Joy Loaders, 250V. D.C.
1—14BU-7RBE Joy Loader
2—14BU-7RAE Joy Loader, 250 V. D.C.
2—14BU-3PE Joy Loaders
7—14BU-2E Joy Loaders, 250V. DC, 25" O.H.
5—12BU-9E Joy Loaders
1—8BU Joy Loader, Rebuilt
2—Myers Whaley, #53 Loaders
1—360 Goodman Loader
1—Canton Track Cleaner
4—8SC Shuttle Cars, Elevating Discharge
4—8SC, 5E and 5EX Joy Shuttle Cars, matched pairs, disc brakes, elevating discharge
16—8SC Joy Shuttle Cars
3—10SC Joy Shuttle Cars, Elevating Discharge
2—5SC Joy Shuttle Cars, Matched pair
2—32D Joy Shuttle Cars
2—32E7 Joy Shuttle Cars
3—32E10 Joy Shuttle Cars, Rebuilt
1—32E16X Joy Shuttle Car, Rebuilt
7—42E15 Joy Shuttle Cars, Matched pairs
2—42E7 Joy Shuttle Cars
5—T2-2E Joy Cat Trucks
1—T2-5 Joy Cat Trucks
5—PL11-7PE and 8PE Joy Elevators
2—Acme Self-Propelled, 40 h.p. Air compressors, Permissible
1—50 h.p. Acme, 210CFM Compressor
1—WK29 Sullivan Air Compressor
2—240 cu. ft. WK-83 Joy Compressors, rubber mounted, self-propelled, 30" O.H., Excellent
1—210 cu. ft. Acme Compressor, on rubber
2—125 cu. ft. WL-82 Sullivan Compressors, rubber mounted and self-propelled
3—Joy T12 Supply Jeeps, Battery complete w/Batteries and Chargers
1—MSA Bantam Rock Dusters on tires
1—Fletcher Roof Bolting Machine, Sliding Head
1—CD25 Joy Coal Drill, Perfect
9—Masson Jeeps with 9J Motors

CONVEYORS

963'—48" Belt Conveyor, complete
1,500'—44B Jeffrey, 36" Belt Conveyor Structure
1,000'—36" Joy Belt Conveyor
1,330'—36" Joy Model C, underground Belt Conveyor
8—36" Joy Belt Drives
1—36" x 150' Belt Conveyor
4—42HC 30" Tandem Belt Heads, 30 h.p. Drive
1—MTB Ladel Tandem, 20" Belt Conveyor Drive 25 h.p.
2,560'—30" Jeffrey 52B Structure
675'—30" Barber Greene Structure
2—30" Belt Conveyor Drives, shop constructed w/15 h.p. Motor and controls
8,994'—26" Joy Belt Conveyor, Model "C"
2,450'—26" Joy MTB Belt Conveyor
19 26" Belt Drives of various types

300'—24" Goodman Belt Conveyor, complete
3—20" Joy Chain Conveyors, Permissible
12—15" Long Chain Conveyor, 350' centers complete w/400 DBH Long Mobile head drive, 25 h.p. Motor, 250V D.C. Cat mounted
4—15" Joy Chain Conveyors, Permissible
24—15" & 12" 61EW, 61HW, 61W and 61AM Jeffrey Chain Conveyors
8—G12½ Goodman Shakers, complete w/10' 21½" Pans
20—G12½, G15 & G20 Goodman Shakers
2—PT12 Long Piggyback Conveyors
29—Goodman Power Duckbills, Model 477
2—PT15 Long Piggyback Conveyors
16—PT15-B Long Piggybacks with 5 h.p. 250 V. Motors

SUB STATIONS & TRANSFORMERS

1—500KW G.E., MG Set
5—300KW MG Sets
5—200KW MG Sets
1—200KW, G.E. HCC8, 2300/4000 Volt Rotary Converter
1—150KW G.E. Rotary Converter w/Transformers
1—150KW Rotary Converter—Completely Automatic
15—150KW MG Sets of various makes and primary voltages
2—100KW Motor Generator Sets
1—100KVA Gasoline Generator Unit
2—50KW, MG Sets, 125 V. D.C., 1200 rpm
2—Armatures for 150 & 200KW Rotary
2—600 & 800 Auto Transformers
150—Transformers from 5KVA to 500KVA

CUTTING MACHINES

1—11RU Sullivan, 9' Bar & Chain
1—624 Goodman Slabber
5—7AU Sullivans
4—7B Sullivans
16—11B Sullivans, 35 & 36 h.p.
16—12AB & A, 12AA Standard Goodmans
2—11AA Universal Goodmans
9—212AA, Baby Goodmans, 250 Volt
9—512 and 712 Goodmans w/Bugdusters
1—29U Jeffrey, 250 Volt
1—29U Jeffrey, 220/440 Volt A.C.
33—35B & 35BB Jeffreys, A.C. & D.C. Bugdusters and Trucks available

LOCOMOTIVES

2—20 Ton MH77 Jeffreys, 42" t.g.
1—13 Ton HM628 G.E. Locomotive, 90 h.p. units, 44" O.H., 48" t.g., Excellent
9—13 Ton Locomotives, 250 Volt, any gauge
1—12 Ton 288 Goodman Locomotive, 40" O.H.
9—10 Ton Locomotives, 250 Volt, any gauge
15—8 Ton Locomotives, 250 Volt, any gauge
8—7 Ton Atlas Battery Locomotives
1—8 Ton Battery Locomotive—NEW
27—6 Ton Locomotives, any gauge
4—6 Ton Jeffreys, MH150 Locomotives
11—6 Ton MH96 Jeffrey Locomotives
16—5 Ton Locomotives, 250 Volt
18—4 Ton Locomotives, 250 V., any gauge
1—4 Ton G.E. Battery Locomotive
1—4 Ton Mancha Battery Locomotive

TIPPLE EQUIPMENT

1—4 Cell Jeffrey Baum Jig Washer
1—CMI Coal Dryer, 48", Excellent
1—Heat Dryer—Complete
1—Marion Double Roll Primary Crusher
1—24" x 50" Pa. Single Roll Crusher
1—30" x 30" Jeffrey Single Roll Crusher
2—24" x 24" Jeffrey Single Roll Crushers
1—18" x 12" Jeffrey Pulverizer
1—5' x 14' Double Deck Vibrator
1—4' x 12' Double Deck Vibrator
1—3' x 8' Low Head Vibrator
5—Jeffrey Traylor Vibrator Feeders
4—Jeffrey Traylor Vibrator Screens
1—Magnetic Separator, Complete
1—Set Jeffrey Dewatering Screens
5—Screper Conveyors of various sizes
10—Tipple Belts from 15" to 42" width
1—30' x 42" Loading Boom
Air Valves, Blowers, Pumps, New Screens, Parts for CMI Dryers, Speed Reducers, Feeders and many other parts for Tipple.

MINE CARS

121—36" t.g. Drop Bottom Cars
248—42" t.g. End Dump Cars, Various makes
22—42" t.g. ACF 6 Ton Drop Bottom Cars
33—44" t.g. Drop Bottom Cars, 10 Ton
148—44" t.g. Drop Bottom Cars, Various sizes
336—44" t.g. End Dump Cars, Various sizes
313—48" t.g. S.D. Drop Bottom Cars, 22" O.H.
134—48" t.g. ACF Drop Bottom Mine Cars, 34" O.H.
4—50½" t.g., 3 Ton, 4 Wheel Push Trucks

RAIL AND WIRE

840—Tons 40, 56, 65 & 70 lb. Relaying Rail
170,901'—1,000,000 CM Feeder Cable
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42,065'—500,000 CM Insulated Copper Feeder Wire
• 770'—500,000 CM Bare Copper Feeder Wire
3,000'—350,000 CM Insulated Copper Feeder Wire
1,510'—4/0 Stranded Insulated Copper
648'—4/0 Stranded Bare Copper
31,400'—4/0 Stranded Highline Wire
63,240'—6/0 Trolley Wire
1,000'—3/0 Solid Copper Trans. Line
24,200'—2/0 Solid Copper Trans. Line
5,982'—1/0 Solid Copper Trans. Line
2,441'—#4 Transmission Wire
1,480'—#6 Transmission Wire
20—Spools New Telephone Wire
5—HKL Brown Fayro Car Spotters
2—CH Sullivan 5 h.p. Car Spotters
1—HKG Brownie Layer Loader Hoist
96—Hoists from 5 h.p. to 800 h.p.
520—Stationary Motors: ½ to 800 h.p. of various specifications
1—Prefab Building, 40' x 84'
1—Prefab Building, 12' x 120'
110—Pumps from ¾" to 4500 GPM of various specifications
1—10 h.p. Deming Deep Well Pump
1—330 GPM 6" Pomona Deep Well Pump
1—14" Centrifugal Slurry Pump w/15 h.p. Motor
3,318'—3½" Galvanized Pipe
903'—1½" Black Pipe
1,000'—2" Plastic Pipe
25,765'—2" Black Pipe
500'—4" Black Pipe

MISCELLANEOUS (CONT'D.)

313—Mine Fans from 30" to 6' Hi Pressure
108—Coal Drills, 571CP, 572CP, 573CP, 473CP, A6 and A7 Jeffrey
3—Sullivan Jumbo Drills, truck mounted
1—WK29 Sullivan Air Compressor, 120 cu. ft. capacity, 48" t.g.
2—Centro-I Compressors, 120 cu. ft. capacity 46" t.g.
1—Canton Track Cleaner, presently 48" t.g.
5—Cleveland Steppers
13—Scales for Mine Tracks
22—Air Compressors of various sizes
11—Rock Dusters up to 30 h.p. track and rubber mounted
1,039—Edison Lamps, Model P & R4
57—Auto Starters from 3 h.p. to 100 h.p.
1—Dust Collector for Roof Bolting
22—18" x 24" I Beams

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Several hundred feet #2 and #3, 2 conductor Machine Cable
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1 11BU Loader 250 volt DC
2 14BU Shuttle Cars 40 HP Motors
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(We are at present dismantling four large mines with modern equipment and complete cleaning plants.)
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WE OWN WHAT WE ADVERTISE

JOY EQUIPMENT—REBUILT
3—Joy 14-BU Loaders, low pedestal, 7AE.
2—Joy 14-BU Loaders, medium pedestal, 7RBE.
1—Joy 14-BU Loader, high pedestal, 7BE.
6—12BU 10E Joy Loaders complete with Piggybacks.
2—Joy 12-BU Loaders, 9E, latest type.
1—Joy 12-BU Loader, 220 volt AC.
1—Joy 20-BU Loader, latest type.
1—Joy 11-BU Loader, latest type.
2—Joy 8-BU Loaders, 250 volt DC.
1—Joy 8-BU Loader, 34" overall height
2—Joy 8-BU Loaders, 220 volt AC.
1—Joy curved Bar Head, complete.
4—Reliance 38-J Motors.
6—Reliance 24-J Motors, 7½ H.P.
4—Reliance 10-J Motors, 5 H.P.
3—Reliance 15-J Motors, 7½ H.P.
20—9-J Motors, 4 H.P.
6—New Wheel Units for Joy 6SC Shuttle Cars.
1—Goodman 660 Loader on cats, excellent.
1—Goodman 665 Loader on cats, latest type.
1—Goodman 865 Loader, 26" hi.
2—Joy 8SC Shuttle Cars, rebuilt.
2—Joy 6SC Shuttle Cars, rebuilt.
2—Joy 5SC Shuttle Cars, rebuilt.
2—Joy 32E9 Shuttle Cars.
2—Joy 32E10 Shuttle Cars, rebuilt.
2—Joy 32E15 Shuttle Cars, rebuilt.
1—Joy 42E16 Shuttle Car, rebuilt.
2—Joy 42E16 Shuttle Cars, rebuilt
8—Small Rubber-Tired Shuttle Cars.
3—Low Vein Rubber-Tired Tractors.
3—Joy CD-22 Drills, like new.
4—Joy T-2-5 low pan Cat Trucks.
1—Joy T-2-6 low pan Cat Truck with reel.
2—Joy T-1 Standard Cat Trucks, 220 AC.
1—Joy T-1 Standard Cat Truck, 250 DC.
2—Joy 11-B Cutting Machines, like new.
1—Joy 7-B Cutting Machine, like new, 250 volt DC.
2—Goodman 212 Cutting Machines, 19" high.
4—Goodman 312 Cutting Machines, 17" high.
3—Goodman 412 Cutting Machines, 19" high.
2—Joy 7-B Cutting Machines, 220/440 volt AC.
1—Goodman Machine on Cats, 31" high. All hydraulic.
6—Goodman 512 Machines with Bugdusters.
1—Goodman 512 Cutting Machine, perfect.
4—Goodman 512 Cutting Machines, 220/440 volt AC.
3—Goodman 112 Cutting Machines, 220/440 volt AC.
1—Lee Norse low vein Machine Carrier on rubber.
1—Jeffrey 70 URB, rubber-tired Cutter, Universal head, perfect condition.
1—Joy 10RU Rubber Tired Cutter, first class.
1—Joy 11RU Rubber Tired Cutter with bugdusters, Universal head, like new.
1—Sullivan 7AU on rubber.
2—Jeffrey 29UC Cutting Machines, Universal head, cuts anywhere in seam, 38" high, on cats, 250 volt DC.

LOCOMOTIVES
1—Goodman 6 ton 91-A, 27" high, armor plate frame.
2—Jeffrey 13 ton, type MH-110, 36", 42" and 44" Ga.
2—Jeffrey 10 ton, type MH-110, 42" and 44" Ga.
1—Jeffrey MH-124, 6 ton, 24" overall height.
12—Jeffrey, 6 ton, type MH-88, 42", 44" and 48" Ga.
2—Jeffrey, 8 ton, type MH-100, 2" armor plate frames.
1—Jeffrey, 6 ton, type 2186, 22" above rail.
3—Jeffrey, 4 ton, type MH-96, 42", 44" and 48" Ga.
1—G.E., 4 ton, type 825 Locomotive, 22" high.
10—G.E., 6 ton, types 801, 803, 821 Locomotives, 42", 44" and 48" Ga.
1—G.E., 8 ton, type 822 Locomotive, 44" Ga.
3—G.E., 10 ton, type 809 Locomotive, 42", 44" and 48" Ga.
2—Goodman, type 33, 6 ton, 44" and 48" Ga.
3—Goodman, 8 ton, type 32A, 36", 44" and 48" Ga.
3—Westinghouse, type 902, 4 ton, 42" and 48" Ga.
2—Westinghouse, type 904, 6 ton, 44" and 48" Ga.
2—Westinghouse, type 906, 44" and 48" Ga.
2—Westinghouse, type 907, 10 ton, 44" and 48" Ga.
8—Jeffrey MH-78 Locomotive Units, cheap.

LOCOMOTIVES (Cont.)
3—Plymouth Diesel Locomotives, 8 and 10 tons, 42" and 44" Ga.
4—Jeffrey MH-88 Locomotive Units, real bargains.
6—Jeffrey MH-100 Locomotive Units, reasonable.
Locomotive Trucks and Spare Armatures for all the above.

TIPPLE EQUIPMENT
5—Complete Tipples, 3 to 5 Track, wood & Steel.
3—Cleaning Plant, 1 Each McNally, Roberts & Shaffer, Jeffrey Washers and Air-flo Tables.
1—Roberts and Shaefer hydro-separator. tandem
1—Allis Chalmers 5'x14' Rippflo Vibrator.
1—5'x14' Robins double deck vibrator.
1—4'x10' Robins Gyrex Vibrator.
Belt & Apron type Loading Booms.
Shaker Screens
1—Robins Car Shakeout.
10—Crushers, various sizes.
Feeders Belt and Drag Conveyors, Car Retarders etc.

CUTTING MACHINES
1—Joy 11RU, rubber tired, Cutter.
1—Joy 10RU, rubber tired, Cutter.
1—Jeffrey 70 URB Cutter, rubber-tired, Universal head, low vein.
2—Jeffrey 29UC Universal Machines on Cats.
1—7AU Sullivan on rubber.
1—Goodman on cats, 31" overall height.
3—Boby Goodman 212's, rebuilt, 250 volt DC.
2—Goodman 212 Cutting Machines, 19" high.
4—Goodman 312 Cutting Machines, 17" high.
3—Goodman 412 Cutting Machines, 19" high.
4—Goodman 312's, 17" high.
6—Goodman 512's with Bugdusters, like new.
4—Goodman 512's, rebuilt, or as removed from service.
4—Goodman 512's, 220/440 volt AC.
3—Goodman 112's, 220/440 volt AC.
2—Joy 7-B Cutting Machines, 220/440 volt AC.
2—Joy 11B Cutting Machines, rebuilt.
6—Goodman 12AA's and 112AA's, 250 volt DC.
2—Goodman 324 Slabbers.
2—Goodman 724 Slabbers.
6—Jeffrey 35L's, like new, 17" high.
2—Jeffrey 35L's, on low vein trucks.
15—Jeffrey 35B's and 35BB's.
2—Jeffrey 29B's on track.
2—Jeffrey 29C's track mounted.
2—Jeffrey 29L's on track, perfect.
3—Sullivan CE7, 220 volt AC.
2—Sullivan CR-10's, 15" high.

LOADING MACHINES
6—Joy 12BU with Piggy-Back Conveyors.
16—Joy Loaders all types.
1—Goodman 865 Loader, 26", on cats.
1—Goodman 665 Loader, on cats.
1—Goodman 660 Loader, on cats.
1—Goodman 460, rebuilt.
2—Jeffrey 61 C18's, on rubber, 26".
3—Jeffrey L-500 Loaders.
2—Myers Whaley No. 3 Automatic Loaders.
2—Clarkson Loaders, 26" above rail.

CONVEYORS
2—Joy 30" Underground Belt Conveyors, 500' to 2000' each. Excellent.
2—Goodman 97-C, 30" Conveyors, 1500' long.
1—Barber-Greene 30" Belt Conveyor, 350', Excellent.
1—Robins 30" Belt Conveyor, 500'.
1—Jeffrey 52-B, 26" Conveyor, 1200' each.
1—Jeffrey 52-B, 30" Drive and Tail Assembly, complete.
3—Robins 26" tandem drive Belt Conveyors, 1,000' to 2,000' long. Excellent condition.
2—Joy MTB 30" Drive and Tail Assembly, complete.
3—Goodman 97 HC 30" Drive and Tail Assemblies, complete.
8,000' Conveyor Belt, 30".
10,000' Conveyor Belt, 26", like new.
2—61EW Elevating Conveyors.
2—61WH 15" Room Conveyors, 300'.
2—Joy 15" Room Conveyors, 300'.
2—Joy 20" Conveyors, 300'.
4—Joy Ladel UN-17 Shakers.
10—Goodman G-12½ and G-15 Shakers.

CONVERTERS AND DIESEL PLANTS
2—100KW, G.E. TCC-6's, 275 volt, Rotary Converters.

CONVERTERS AND DIESEL PLANTS (Cont.)
1—150KW, G.E. HCC-6, 275 volt, Rotary Converter.
1—150KW, 6 phase, Allis Chalmers Rotary Converter, 275 DC.
1—200KW Allis Chalmers Rotary Converter, 6 phase, 275 DC, perfect.
1—200KW, G.E. HCC-6 Rotary Converter, 275 volt DC.
1—300KW, G.E. HCC-6 Rotary Converter, 275 DC.
2—300KW Westinghouse, 6 phase, Rotary Converters, 275 volt DC.
2—500KW Westinghouse Rotary Converters, 275 volt DC.
2—200KW Westinghouse Rotary Converters, 275 DC.
(all the above with 6900/13000 and/or 2300/4000 primary transformers)
2—150KW MG Sets, General Electric and Westinghouse.
1—200KW MG Set, Westinghouse, rebuilt.
1—200KW MG Set, General Electric, perfect.
2—150KW Allis Chalmers MG Sets, 275 DC volt, excellent, 220-440 AC volt.
1—300KW Westinghouse, 600 volt MG Set, rebuilt.
2—300KW Westinghouse, 600 volt, 6 phase, Rotary Converters.
2—500KW Westinghouse, 600 volt, DC, 6 phase, Rotary Converters.
2—500KW HCC-6 Rotary Converters, 6 phase, 600 volt DC.
1—GMC-471 Diesel with 60KW, 250 volt DC Generator.
1—GMC-671 Diesel with 75KW, 250 volt DC Generator.
1—Cummins 125 KW, Diesel with 250 volt DC Generator.
1—Allis Chalmers Natural Gas Engine with 100KW Generator, 275 volt DC.
1—700 H.P. Shaft Hoist, complete.
Complete steam plant, will sell all or any part.
Boilers, like new, 1100 H.P. and 500 H.P. Also transformers, turbines, etc.

MISCELLANEOUS
5—Complete Tipples, 3 to 5 Track, wood and steel.
20—Jeffrey Molveyors on rubber tires.
1—¾ Yard Shovel and Back-Hoe.
1—¾ Yard Crane on Cats.
Battery Supply Tractors, rubber tired.
1—Cantrell Air Compressor on rubber tires.
10—Air Compressors, 1 H.P. to 40 H.P.
2—Joy self propelled rubber tired compressors, 240 cu. ft.
2—Acme self propelled rubber tired compressors, 130 cu. ft.
40 Mine Pumps, all types.
1—Differential 40 Passenger Man-Trip Car.
6—MSA Rock Dusters.
2—Phillips Carriers, 44" and 48" Ga.
2—Barber Greene self propelled Bucket Elevators.
Pipe, Plastic, Steel, Transit, all sizes 1" to 6".
100 Mine Cars, drop bottom, 42" Ga.
30 Mine Cars, drop bottom, 44" Ga.
100 Mine Cars, 18" high, end dump, 44" Ga.
300 Mine Cars, end dump and drop bottom, 20" high, 48" Ga.
1—10 ton Mine Car Scale with Recorder.
15—Brown Fayro HKL and HG Car Spotters.
1—12 ton Differential Slate Larry.
Incline Hoists, 25 to 50 H.P.
1—Jeffrey 5' Aerodyne Fan, like new.
1—Jeffrey 6' Aerodyne Fan.
1—Jeffrey 8' Aerodyne Fan.
2—Storage Tanks, 4,000 Gallon.
1—Storage Tank, 10,000 Gallons.
10,000 Five Gallon G. I. Cans, screw lids.
2500 tons Relaying Rail, 25#, 30#, 40#, 50#, 60#, 70#, 80#.
100 tons Copper—4/0 and 9 Section Trolley 1/0, 2/0, 4/0 Stranded. 500 MCM and 1,000 MCM Feeder Cable.
Thousands of feet of rubber covered three conductor cable.
300 Transformers from 1 to 2,000 KVA, 110 to 13,000 primary volts.
400 Electric Motors, 3 to 250 H.P.
Huge stock of mine supplies.
Thousands of Other Items.
600—MSA Mine Lamps, Chargers, etc.
1—Fricks Saw Mill—Complete.

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PHONE 2825 **LOGAN, W. VA.**

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ANOTHER COAL STRIP-MINING REPORT ON

THE COST-CUTTING D9

IF YOU want a money-saving tool for strip mining, then see what the Bolt Mining Co. of Beckley, West Virginia, is doing with the Cat D9 Tractor equipped with No. 9 Ripper and No. 9A Bulldozer pictured above.

The company bought this D9 primarily for ripping a cover of shale over a bituminous coal seam of 48". Result: efficient removal of approximately 6-7,000 yd. of overburden per 20-hour day.

According to James C. Justice, general manager, it would take four men with jackhammers or two wagon drills to get the same production—and there would be the added cost of explosives.

Bolt uses another D9, plus four D8s and a D7, for removing overburden and for maintaining haulage. In this application: "Under ideal conditions we have found that the D9 can move dirt at about the same price as a 5-yd. shovel," says Mr. Justice. No wonder the firm is standardizing on Caterpillar!

Ripping or 'dozing, the Caterpillar D9 Tractor is ready to give you remarkable cost savings and keep production high. Many strip-mine owners find that a D9, by reducing costs, completely pays for itself in a few months. And now the D9 is available with *lifetime* lubricated rollers—a Caterpillar exclusive!

You could be missing out on a machine valuable to your operation. Call your Caterpillar Dealer soon and have him bring the D9 to your job for a demonstration.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

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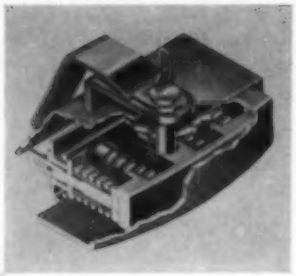
D9—MODERN WAY TO HIGH PRODUCTION, LOW COST



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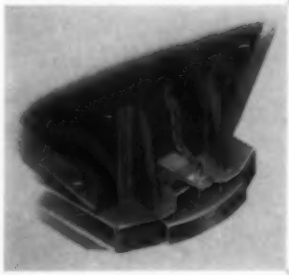

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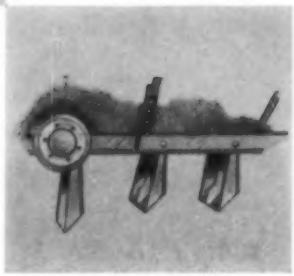

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increase haulage efficiency

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Every acf Constant Haulage Mine Car—drop-bottom, end dump, or rotary dump—pays off in extra productivity, lower maintenance costs. No matter what type or size your operations need, from 20 to 30 tons or more, there's a service-proved acf design that's right for the job. Why not discuss your haulage problems with an experienced acf representative. Just contact the nearest acf sales office or write department CA-3.

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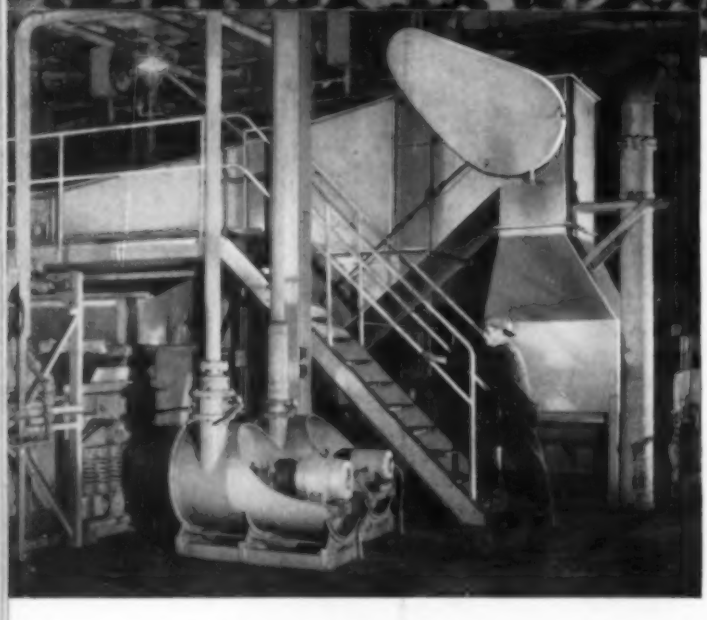

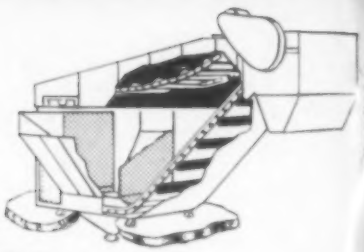

AT CLINCHFIELD

LINK-BELT TANK-TYPE FLOAT-SINK CONCENTRATOR satisfies cleaning requirements of Clinchfield Coal Company's new preparation plant (Clinchfield, Russell County, Va.). This coal washer utilizes the heavy-media separation process in a magnetite and water mixture. Efficient for extremely high or low specific gravity separation . . . when a large percentage of coal is near the separation gravity . . . when amount of impurities in feed fluctuates or product must be quickly changed. Cleans larger sizes, minimizing manual picking.

PICTURED are just two of many progressive mine operations in which Link-Belt has furnished the answer to particular coal cleaning problems. Whether your operation is best suited to the Link-Belt heavy-media system or the Link-Belt air-pulsated wash box system—impurities are removed at low cost . . . ash percentages are lowered.

Call your Link-Belt office today and ask for Book 2655. Our specialists will work with your engineers in determining the right equipment for a cleaner, more marketable coal at lower cost.

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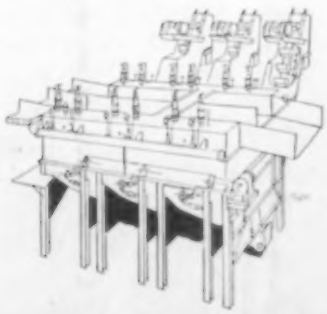
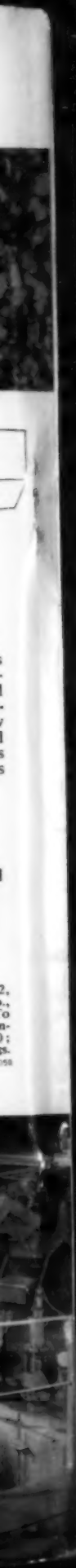


AT JOANNE

LINK-BELT AIR PULSATED WASH BOX was the choice of Joanne Coal Company for its metallurgical coal plant located at Rachel, West Va. Extremely flexible for high-capacity cleaning of sized or unsized coal, Link-Belt air-pulsated washers are available in single and dual bed models to satisfy all capacity requirements. The dual bed model (pictured) has higher capacity due to increased washing bed width and individual bed controls . . . provides sharper separation over the entire washing area. Both models can incorporate the new Aeropoise refuse control for completely automatic refuse discharge.